MAY 16, 1955

# Electrical World

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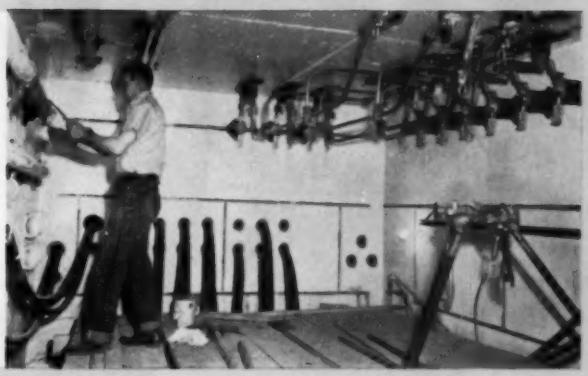
**Tucson utility puts 14-kv underground** . . . Page 99



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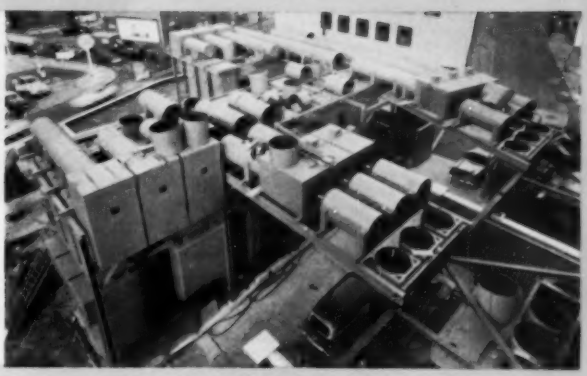

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**The utility industry can be proud** . . . Page 115

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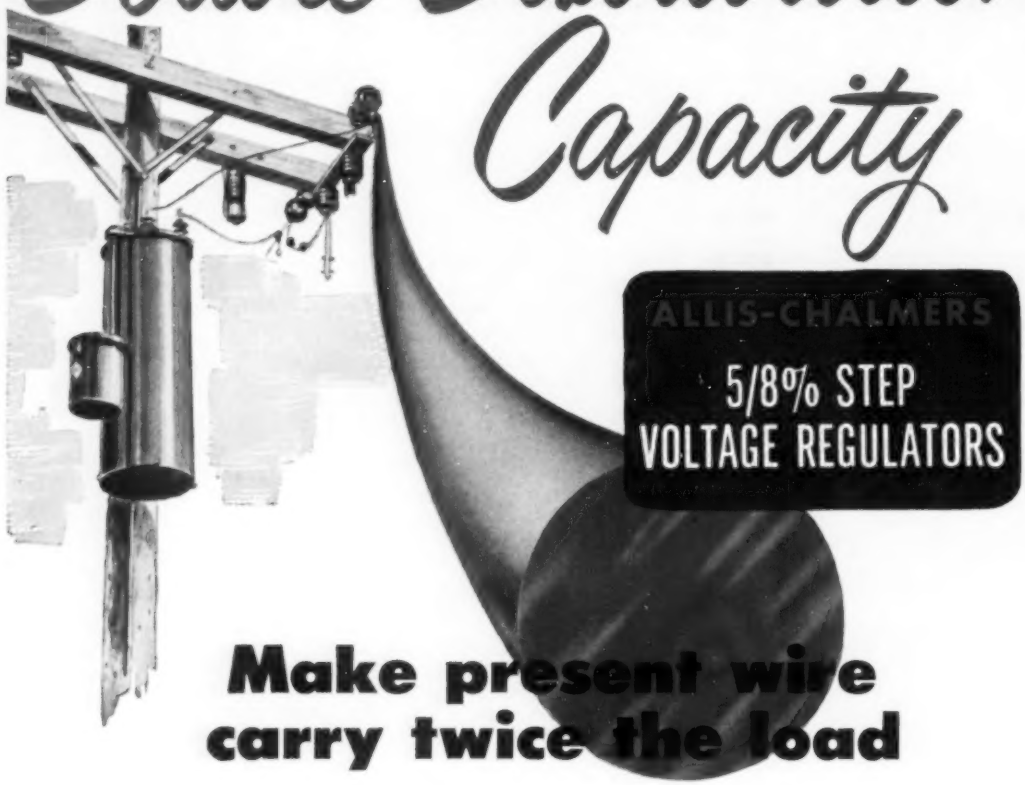


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# Electrical World

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol 143 No 20 May 16, 1955

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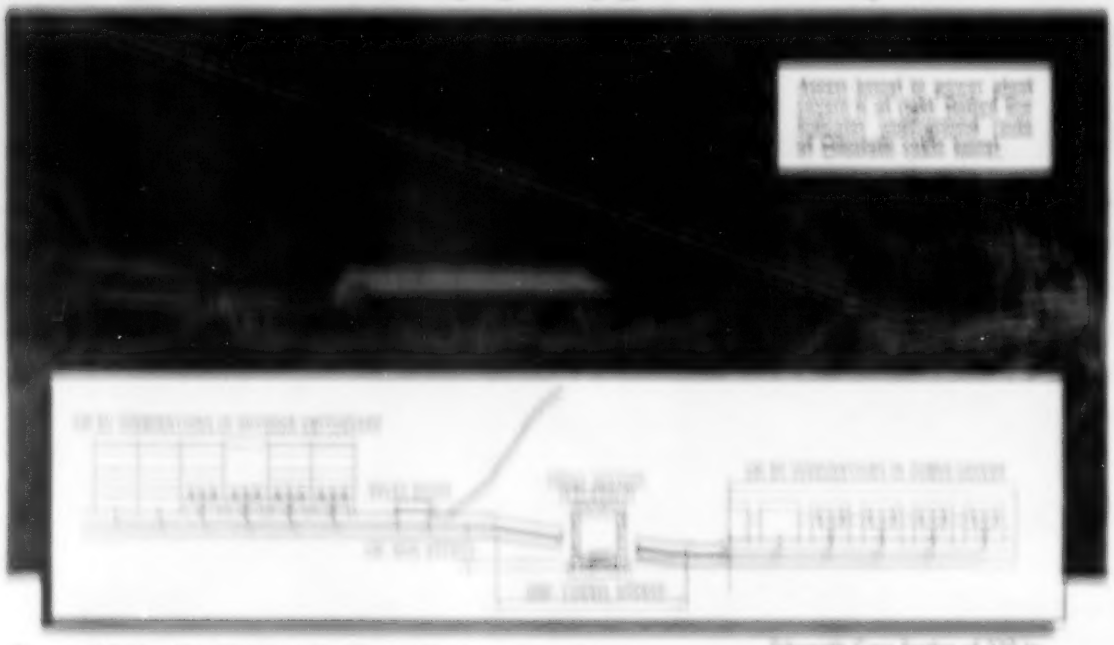
## *the first American-built 230 kv Oilostatic high-pressure oil, pipe-type cable system*



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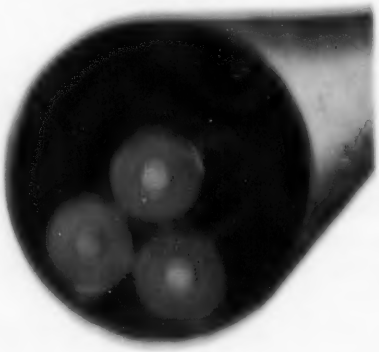

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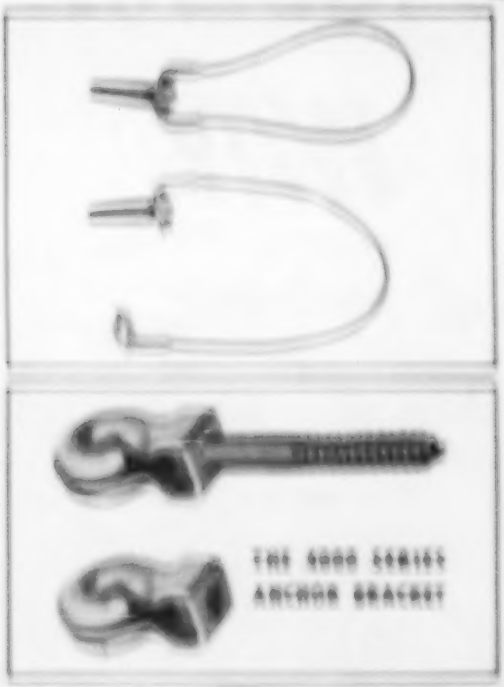
## for Neutral Supported Multiple Conductor Service-Drop Cable



**Electroline Company**

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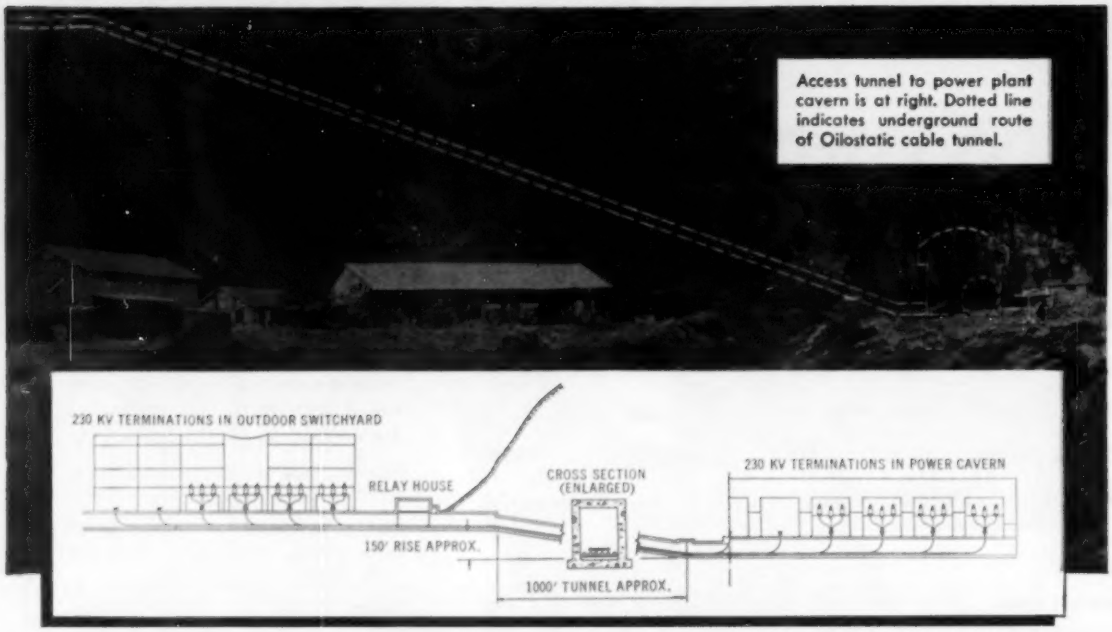
Access tunnel to power plant cavern is at right. Dotted line indicates underground route of Oilostatic cable tunnel.
230 KV TERMINATIONS IN OUTDOOR SWITCHYARD
RELAY HOUSE
CROSS SECTION (ENLARGED)
230 KV TERMINATIONS IN POWER CAVERN
150′ RISE APPROX.
1000′ TUNNEL APPROX.

Schematic Cross-Section of 230 kv Oilostatic Cable System Cubatao Underground Station, Sao Paulo, Brazil.

Okonite's leadership in the development of high-tension cables is again demonstrated by the manufacture of a 230 kv Oilostatic cable—the first American-built 230 kv high-pressure, pipe-type cable system. This cable, recently shipped, was ordered in March, 1951, for installation at the Cubatao Underground Power Plant of the Sao Paulo Light and Power Company Limited, Sao Paulo, Brazil.

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*Available with either copper or aluminum conductors*

**OKONITE** OKONITE SINCE 1878 ***insulated cables***

2591

# Electroline
# AUTOMATIC DEAD-END
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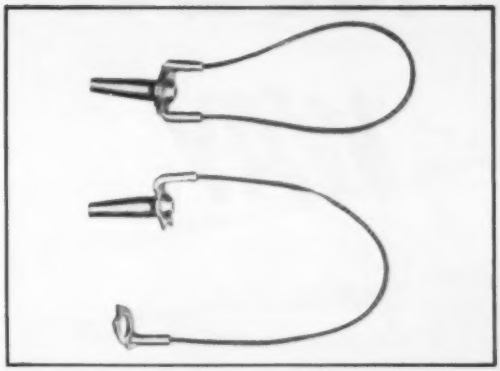

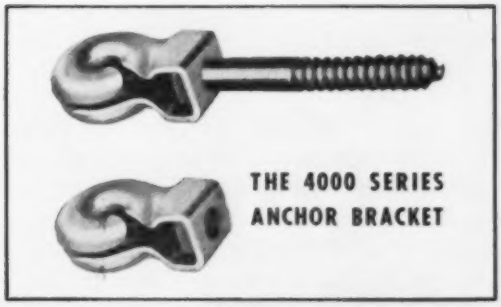


**This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.**

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**ELECTROLINE 4000 ANCHOR BRACKET** — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

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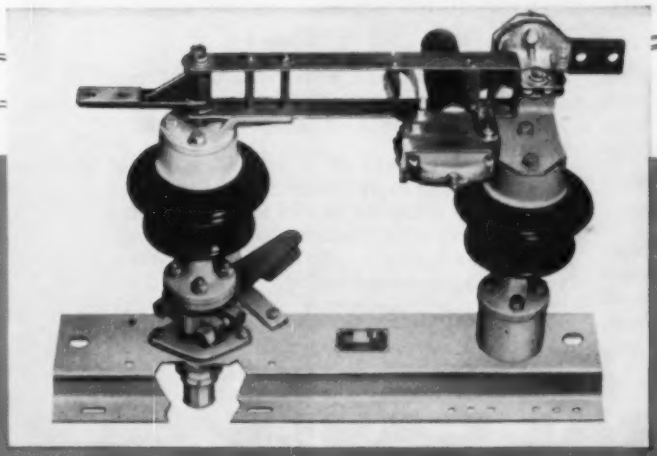

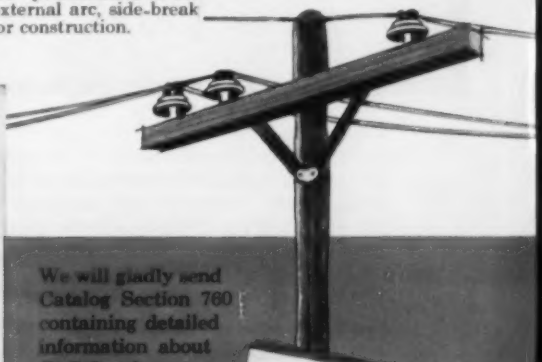

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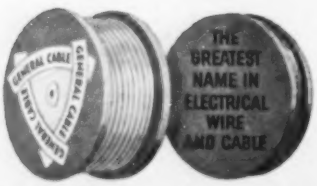


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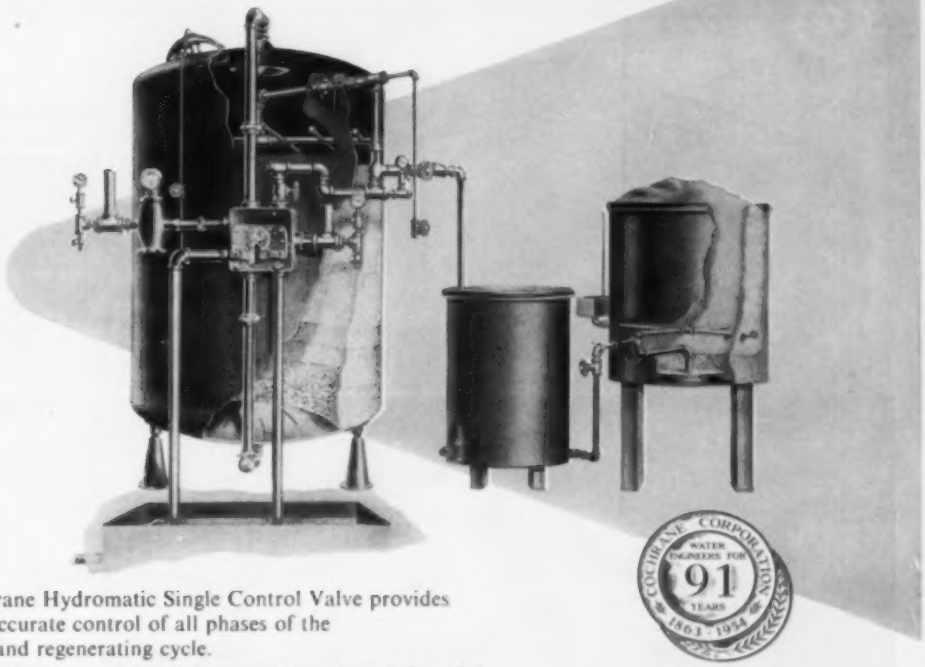

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It is so simple to operate that no technical knowledge of the softening process or the equipment is required. High quality effluent is thus assured at a minimum cost and maximum delivery.

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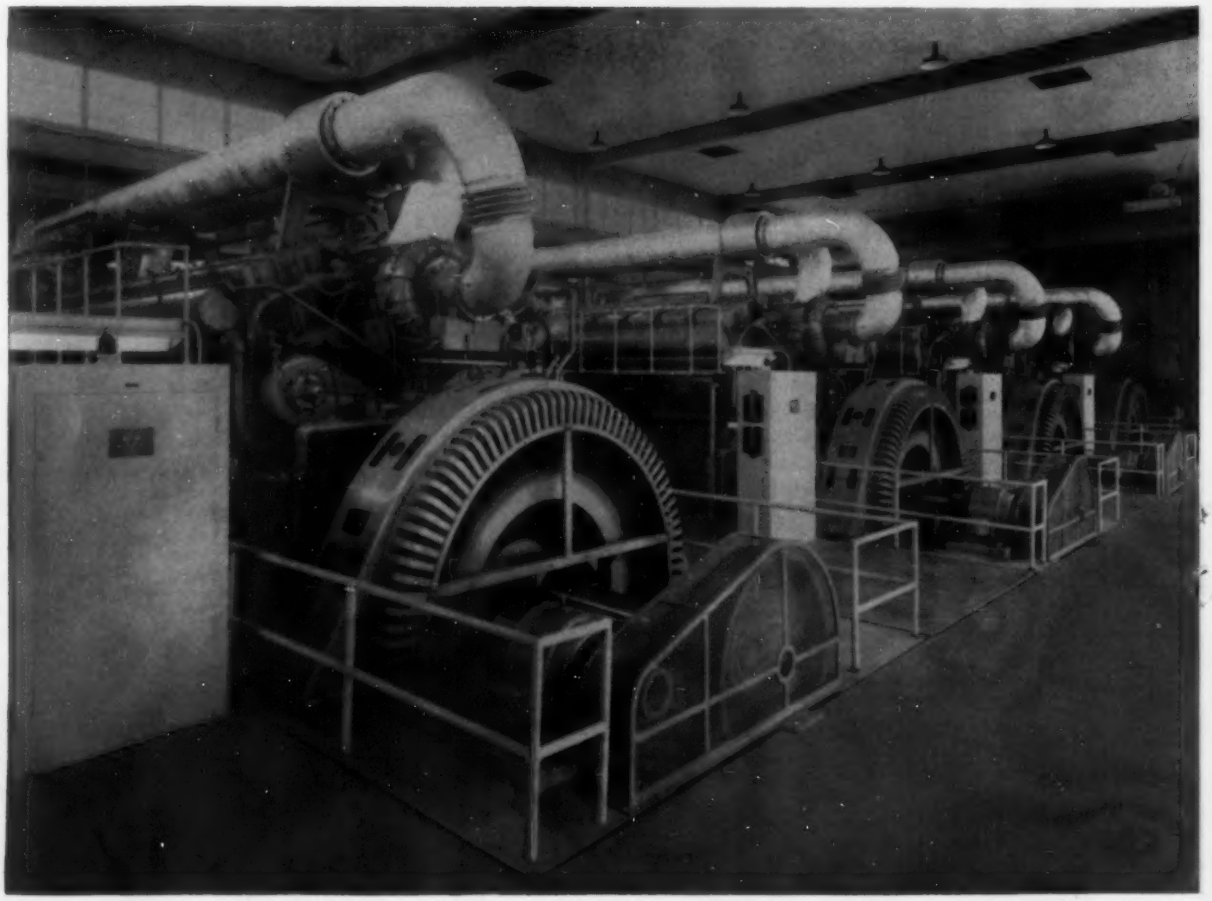
Gulf Dieselmotive Oil provides the vital lubrication for these four Cooper-Bessemer 16-cylinder Diesels in the M & A Plant.



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  **Opening and closing of line valves.**
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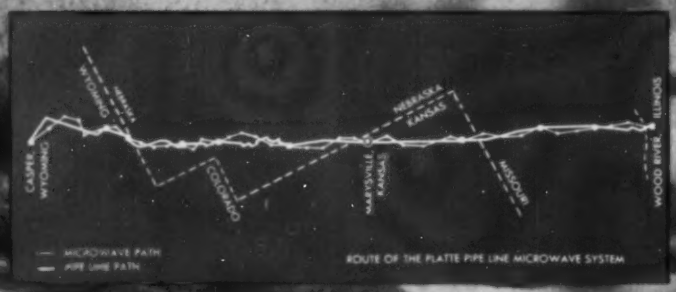
  **Station shutdown.**



ROUTE OF THE PLATTE PIPE LINE MICROWAVE SYSTEM

Platte microwave repeater station at Midway, Wyoming.

PHILCO Finest QUALITY

# PHILCO CORPORATION

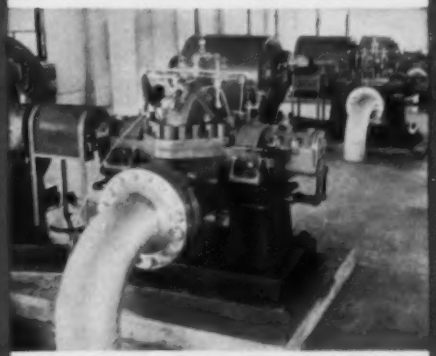
# ..boosts Platte Pipe Line efficiency!

The Philco microwave system of the Platte Pipe Line Company—the largest and most comprehensive installation of its kind—demonstrates the economic advantages of microwave better than any other pipe line microwave system in the nation. Here is what A. R. Heidebrecht, Chief Engineer of Platte, has to say about the system: "Our decision to use microwave was greatly influenced by the number of pipe line control functions which could be accomplished remotely and automatically. Operation to date has proved very successful; in fact, during the short time this system has been in use, the efficiency of our pipe line operation has been substantially increased."

Perhaps microwave can lower operating costs and boost the efficiency of your plant. Philco maintains a staff of experienced field and system engineers who can help plan and install your microwave system. Get information on the many leading Philco microwave installations in use today. Write to Philco, Dept. EW.

Platte Pipe Line control center at Kansas City.

Microwave operates valves along the pipe line.



Pipe line pump station operated by microwave.

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GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44, PENNSYLVANIA

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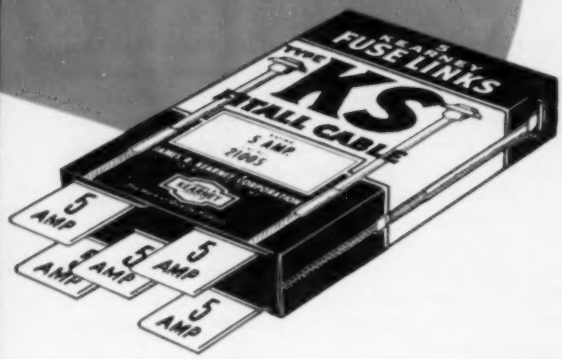
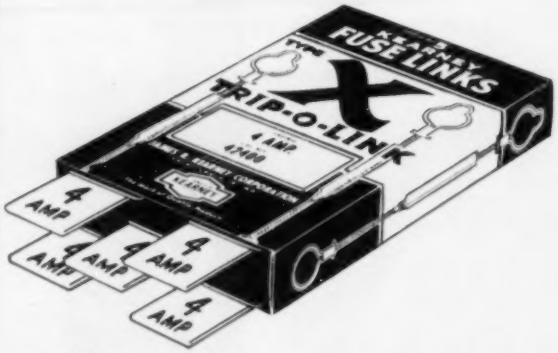
**ALL KEARNEY FUSE LINKS** . . . including EEI-NEMA Standard Types . . . are color-coded to save time and prevent mistakes. They are packaged for easy handling and engineered with the accuracy you need for effective co-ordination. Time-current curves are available to help you work out your coordination.




KEARNEY Type KS . . . specially designed to protect and still keep outages at a minimum on circuits subject to switching and lightning surges.




KEARNEY Type X . . . specially designed to keep transformers in service during overloads and surges . . . yet to protect before the damage range is reached. Opens 230% of rated current load within five minutes.

276

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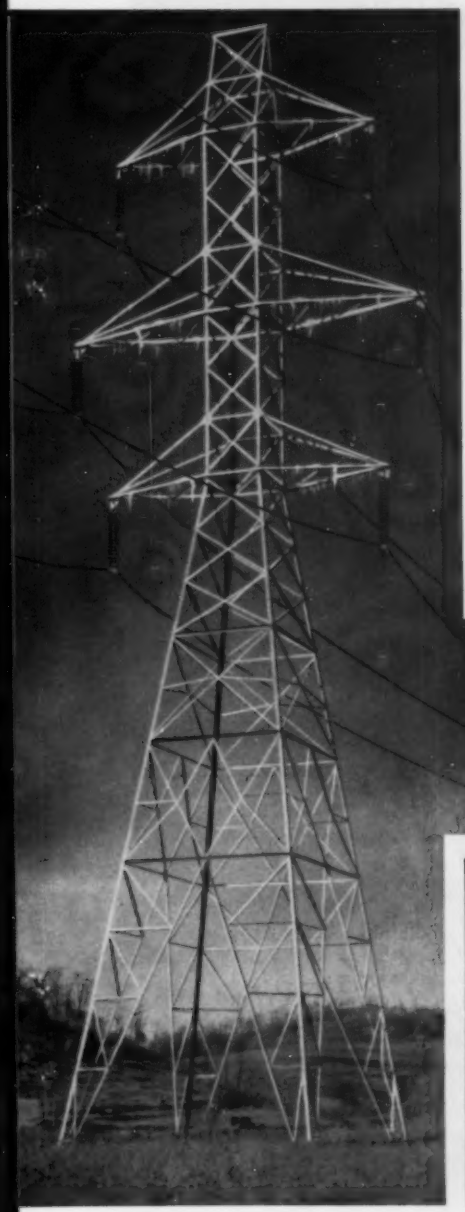


FOR STRONGER, weather-worthy transmission towers, you can rely on AMERICAN BRIDGE. It is backed by 44 years of experience in designing and fabricating transmission towers.

The ability of these tall sentinels to withstand the extremes of wind and ice conditions is proof of good design practice. It is this widely recognized and proven ability to "take it" that has won for these strong, dependable towers the respect of power companies everywhere.

American Bridge towers are a *must* for all important high voltage lines. For example, you'll find them along the 330,000-volt, double circuit Appalachian Electric Power Company link of A.G.&E.'s high voltage transmission network. *These towers are approximately 150-ft. tall and are designed for straight line spans of 1700-ft.*

American Bridge towers are made to order for every type of transmission line service. They are designed for simplified erection on level, side-hill, or rocky butte sites. They are engineered for heavy-duty service under the severest climatic conditions. For recommendations based on your specific requirements, just write our nearest office.

**Designed to carry any load**

**—to fit any terrain!**

Incorporating special design features such as steel grillage earth anchors and variable leg extensions, American Bridge towers make possible important savings in time, labor, and material costs.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.

Contracting Offices in: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · ELMIRA · GARY MEMPHIS · MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH · PORTLAND, ORE. · ROANOKE · ST. LOUIS · SAN FRANCISCO · TRENTON UNITED STATES STEEL EXPORT COMPANY, NEW YORK

# AMERICAN BRIDGE

USS

UNITED STATES STEEL

# EXCEEDS CLASS III SPECIFICATIONS

Wet or dry, pick your flashover test, NEW Kimble *Tempered* Glass insulators show flashover resistance exceeding A.I.E.E. requirements. In puncture tests, too, *Tempered* Glass insulators are outstanding. It has proved impossible to puncture them in air, even under the most severe maximum voltage impulses applied. Four years of field testing on more than 500 miles of line have produced no puncture failure. Even lightning surges have failed to damage them.

**If it's on the pin, it's in service**

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. It's a Kimble production method that gives Kimble insulators a hard-compression surface layer that makes them strong enough to meet the severe test required. This great strength saves installation time because it's never necessary to loosen for line up with the conductor—they can always take another quarter-turn.

Why not see how *tempered* glass can cut your line maintenance costs. Write for folder. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-5, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

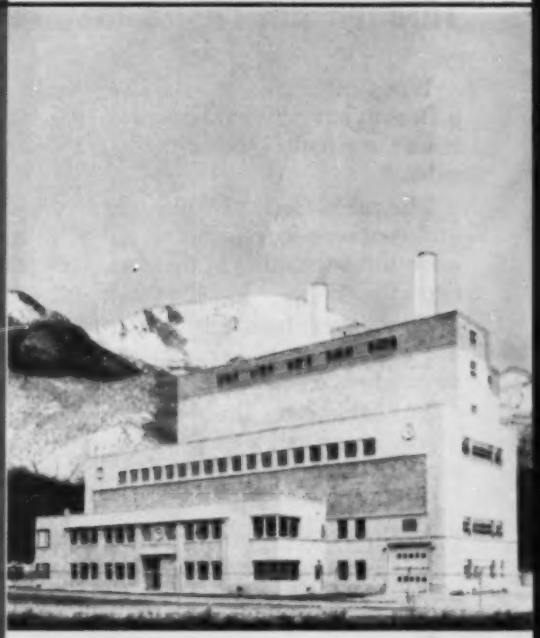
# *Birdsall Power Station benefits from past experience... turbines get* NONPAREIL *Turbine Oil*

Colorado Springs Utility Department had 12 years' experience with NONPAREIL Turbine Oil in other turbines in the system before the George Birdsall Power Station began operations in 1952. When it came to selecting a turbine oil for two 16,500 kw. GE turbines in the Birdsall Plant, NONPAREIL Turbine Oil was decided upon. The trouble-free service already obtained with NONPAREIL helped make the decision to use it in the Birdsall plant an easy one.

There was another factor besides the 12 year trouble-free record that helped the management decide on NONPAREIL. It was the NONPAREIL guarantee which assured them NONPAREIL would last the life of the turbines. This guarantee assures the user that the acidity of the oil will never exceed 0.15 mg. KOH/g. In most cases the acidity level is maintained at a much lower figure, usually on the order of 0.05 mg. KOH/g. Regular inspection by Standard Oil lubrication specialists and analysis of the oil in Standard Oil laboratories serve as a double check on the oil's performance. This adds up to certain, superior lubrication for turbines.

Find out more about NONPAREIL Turbine Oil. In the Midwest, call your nearby lubrication specialist. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

**A truly show-place station is the Birdsall Power Station of Colorado Springs. Two GE 16,500 kw. turbines use NONPAREIL Turbine Oil.**



**C. J. Blasing, Mechanical Superintendent (left), and Standard Oil lubrication specialist E. C. "Con" Jefferies, check lubrication data on GE turbine at Birdsall plant. Providing technical service on lubrication jobs such as this is something for which Con Jefferies is well suited. Con has a number of years experience working with industry on lubrication problems. In addition he is a graduate of the University of Colorado with an ME degree and has completed the Standard Oil Sales Engineering School. Customers find this experience and background pay off for them.**

STANDARD

STANDARD OIL COMPANY (Indiana)

# It Took Only About 10 Minutes to Pull a Simplex-Anhydrex 5KV Cable Through Six Floors of Conduit

When transformers became too heavily overloaded in a Boston office building recently, it became necessary to install a circuit breaker, a unit substation, and a 5kv cable.

The cable, Simplex Anhydrex XX-insulated, shielded, and neoprene-jacketed, was pulled in from the seventh floor unit substation to the circuit breaker on the ground floor.

Negotiating four right-angle turns and approximately 230 feet of steel and fiber conduit, the cable reached the circuit breaker room in about ten minutes.

The cable came through the conduit so fast, the crew at the lower end were hard-pressed to keep the pulling rope from jamming.

Simplex Lubricant No. 3 helped make this fast pulling job possible.

**Simplex Rubber Insulations**

ANHYDREX XX for power cables (3kv to 25kv and over) — resists heat, oxidation and ozone — has low water absorption.

ANHYDREX for power cables (0 to 2kv), and control, communication and signal cables — resists heat and oxidation — has low water absorption.

Write the address below for more details about ANHYDREX.

Simplex

**SIMPLEX WIRE & CABLE CO.**

79 SIDNEY STREET, CAMBRIDGE 39, MASSACHUSETTS

*Top Photo:* Pothead of 500 kva dry-type transformer on seventh floor. Secondary feeds 110/220 volts to four floors above.

*Middle Photo:* Wire mesh grip on sixth floor holds weight of cable. Feeder runs through four-inch steel conduit from first to seventh floors.

*Bottom Photo:* Feeder connection at air circuit breaker on first floor. Cable transmits 4160 volts.

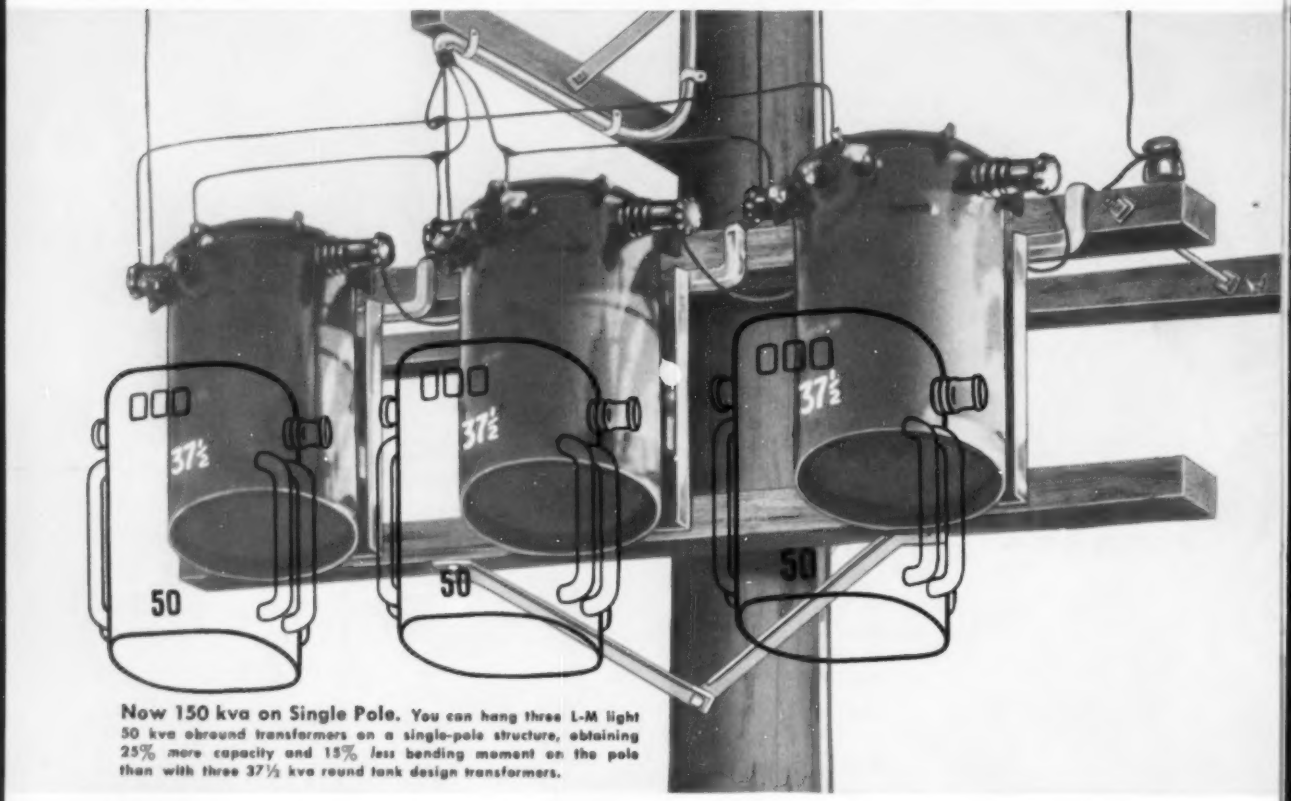
**L-M brings you obround**

with outstanding advantages for overhead distribution

**LINE MATERIAL company**

# How L-M Obround Design Provides Additional Capacity On Structures

**New obround tank design is smaller, lighter, and has shorter moment arm, retaining all outstanding Round-Wound® performance characteristics.**




**Now 150 kva on Single Pole.** You can hang three L-M light 50 kva obround transformers on a single-pole structure, obtaining 25% *more* capacity and 15% *less* bending moment on the pole than with three 37½ kva round tank design transformers.

By **ALVIN B. COYLE**
Manager
Transformer Sales
Line Material Company

Now you can hang transformers of larger capacity on a pole structure with L-M's lighter, smaller obround transformer tank design. The additional capacity is obtained without changing outstanding performance characteristics of L-M's Round-Wound design.

### Less Weight

The obround design provides a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where necessary to provide the cooling surface for maintaining the same low hot-spot and top oil temperature-performance characteristics found in all other L-M transformers. In addition, the transformer's repetitive overload capacity is improved as the result of the faster transfer of heat from the coils to the cooling air.

### Shorter Moment Arm

L-M's new obround design brings the center of gravity closer to the pole, which reduces the moment arm distance from the pole. The combination of lighter weight and less moment arm distance substantially decreases the total bending moment on the pole and crossarms, and thus greatly increases the potential capacity of all your transformer structures.

You can take advantage of savings such as these:

Larger transformers can be hung closer to the top of the pole, eliminating the need for a higher pole and additional spacing.

Single-pole, three-phase transformer structures can now serve more load with the additional transformer capacity available. New 50 kva obround transformers have less bending moment on the pole and on crossarms than previous 37½ kva round tank design. Here L-M's light obround transformers may eliminate the need for costly two-pole structures.

### Pole-Mounted 167 kva Transformers

L-M's light-weight 167 kva transformer can be pole-mounted; provides a full 167 kva of capacity on a single-pole structure. And it, too, provides L-M's well-known overload capacity.

To serve three-phase loads you can hang three L-M light 167 kva transformers or 500 kva on a two-pole structure, eliminate expensive platforms, ground pads, or vaults in many instances, and make further use of existing facilities.

L-M's light, obround design transformers are available in single-phase 5 kva through 167 kva in each standard distribution voltage class.

See performance characteristics and design features on opposite page.

**LINE MATERIAL** Transformers

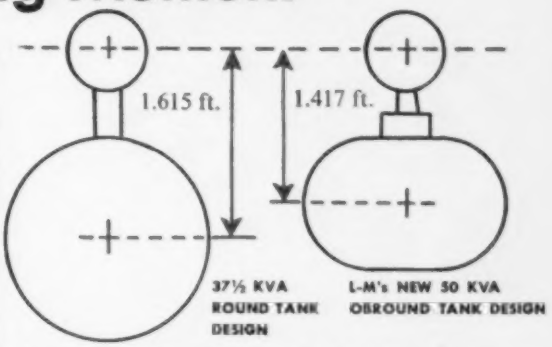
# You Can Hang 25% More Capacity With 15% Less Bending Moment

**COMPARE** 37½ kva round tank design
50 kva L-M obround tank design

**37½ kva ROUND tank design:**
Moment arm from center of pole. 1.615 ft.
Weight. . . . . 800 lbs.
Bending moment 800 x 1.615. . . . **1292 ft.-lbs.**

**50 kva L-M OBROUND tank design:**
Moment arm from center of pole. 1.417 ft.
Weight. . . . . 775 lbs.
Bending moment 775 x 1.417. . . . **1098 ft.-lbs.**

L-M's new 50 kva obround transformer has 15% less bending moment than the 37½ kva round tank design.




**Less Bending Moment**—New obround tank design reduces the moment arm distance from the pole. The combination of lighter weight and smaller moment arm distance greatly decreases the total bending moment on the pole. When crossarm mounted, the lighter weight substantially reduces the bending moment on the crossarms.

**Less Weight, Faster Cooling**—The obround design affords a small tank and less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide sufficient cooling surface.

In addition, oil ducts, located throughout the coil and between the coil and cruciform cross-section of the wound core, contribute to uniform efficient cooling.

Rapid transfer of heat provides faster cooling of the unit, increasing its repetitive overload capacity.

## Plus Outstanding Round-Wound Performance Characteristics

Both the physical and performance characteristics of L-M's obround tank transformer were considered in detail. The advantages of lighter weight and shorter moment arm were accomplished with no sacrifice of outstanding Round-Wound performance characteristics.

**Low Exciting Current:** the continuously wound core of oriented-grain silicon steel strip provides a uniform flux path, thus permitting low exciting current.

**High Impulse Strength:** high-voltage windings are on the outside of the coils, providing maximum distance between the high-voltage windings and the core. This permits ample creepage distance with generous insulation.

**High Short-Circuit Strength:** round coils naturally resist radial short-circuit forces without damage or distortion. Sturdy core clamps and strong blocking aid in preventing axial movement of the windings under short-circuit conditions.

**High Short-Time Overload Capacity:** cruciform cross section of wound core and ducts between windings and layers provide excellent cooling for the entire unit.

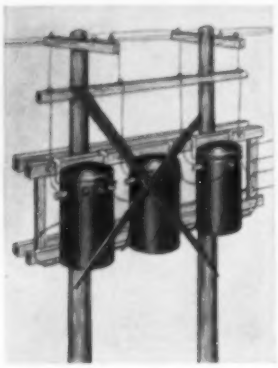
Now you can hang 167 kva directly on the pole, yet L-M's new lightweight obround has full 167 kva continuous rating and no sacrifice in overload capacity.

**LINE MATERIAL**
LM
*Transformers*

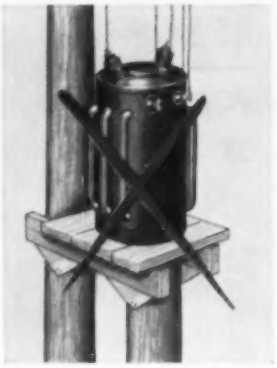


CONTINUED →

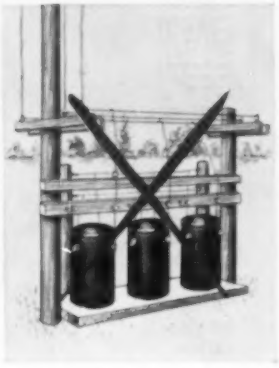
# L-M's Light-Weight Obround Transformer Eliminates Costly Construction Measures



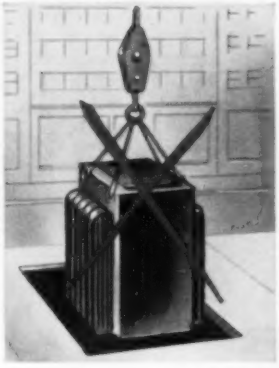
You can now hang more capacity on a single-pole, three-phase structure, serve more load, and reduce or eliminate the need for a two-pole structure.



L-M's new light-weight 167 kva transformer can be pole-mounted, eliminating the need for a stub or platform and making further use of existing facilities.



Mounting three new 167 kva obround transformers on a 2-pole structure provides full 500 kva, eliminates costly alternative measures such as ground-type overhead structures.



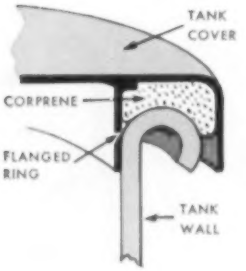
Obround transformers increase the potential capacity of all your transformer structures, reducing the need for expensive underground systems and subway or vault installations.

L-M's light, obround tank design transformers are available in each distribution voltage class, single-phase ratings 5 kva through 167 kva.

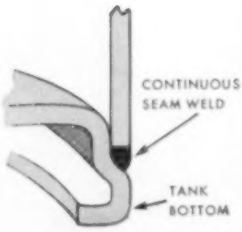
**Get Details On Lighter-Weight, Obround Transformers**

Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write Mr. Coyle at Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

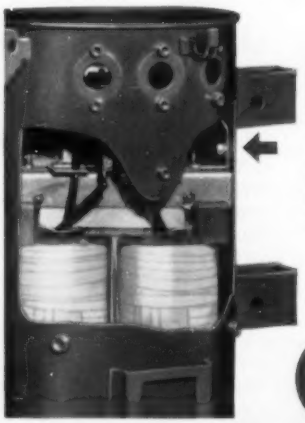
## and of course, L-M means Low Maintenance




**Tanks**—Sealed for the future, not just for today. Resilient Corprene® cover gasket, gas-proof, oil-resistant and ageless, has improved and unexcelled effectiveness in a new removable ring for positive position and retention. Maximum ease of clamping consistent with assured maintenance of seal without attention through the Round-Wound's long service life.




**Tank Base**—L-M's new tank base design adds strength and rigidity to transformer tank unit. The base is bonded to tank wall by a continuous submerged arc weld for effective seal and neat appearance.



**Internal Assembly**—Vibration-proofed against accidental loosening, the core and coil assembly is securely clamped through the use of positive, self-locking nuts and bolts. Similarly, the complete assembly is locked to the tank.

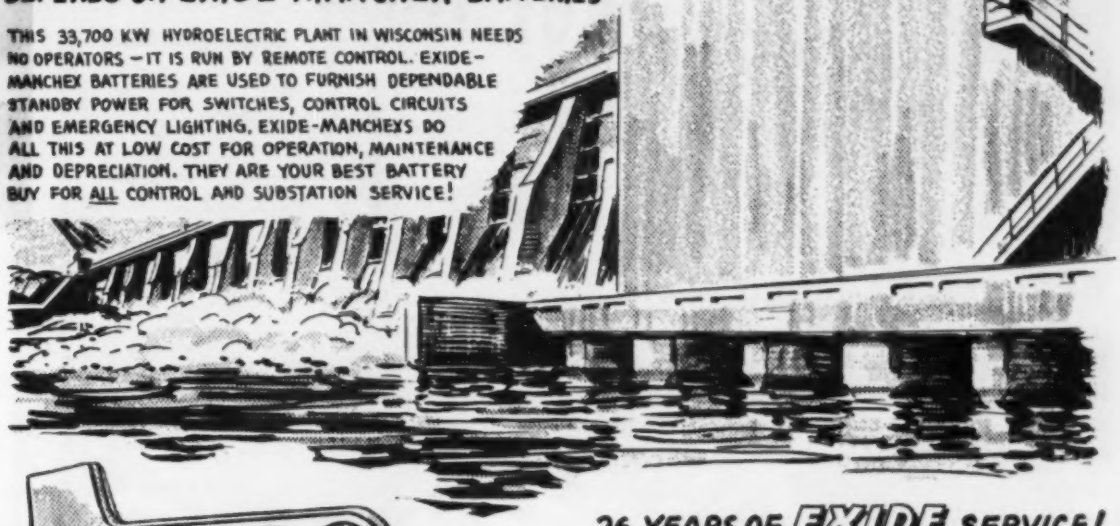
**LINE MATERIAL**

*Transformers*

# FACTS ABOUT Exide®
## CONTROL AND EMERGENCY LIGHTING BATTERIES

### LARGEST U.S. UNATTENDED HYDRO PLANT DEPENDS ON EXIDE®-MANCHEX BATTERIES

THIS 33,700 KW HYDROELECTRIC PLANT IN WISCONSIN NEEDS NO OPERATORS — IT IS RUN BY REMOTE CONTROL. EXIDE-MANCHEX BATTERIES ARE USED TO FURNISH DEPENDABLE STANDBY POWER FOR SWITCHES, CONTROL CIRCUITS AND EMERGENCY LIGHTING. EXIDE-MANCHEXS DO ALL THIS AT LOW COST FOR OPERATION, MAINTENANCE AND DEPRECIATION. THEY ARE YOUR BEST BATTERY BUY FOR ALL CONTROL AND SUBSTATION SERVICE!

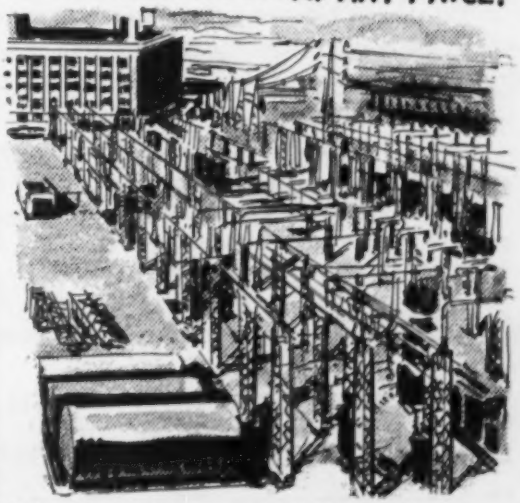


### INSIDE AN EXIDE-MANCHEX
### THE SECRET OF LONG LIFE...
### DEPENDABLE POWER!

THE EXCLUSIVE MANCHESTER POSITIVE PLATES ARE THE HEART OF THE MANCHEX BATTERY...THE SOURCE OF POWER. LEAD BUTTONS ARE PRESSED INTO HOLES OF THE GRID. ONLY A SMALL PORTION OF THE TOTAL LEAD IS FORMED INITIALLY INTO ACTIVE MATERIAL. THE REMAINDER IS AVAILABLE FOR GRADUAL CONVERSION DURING YEARS OF SERVICE. YOU GET LONGER LIFE... MORE DEPENDABLE POWER IN LESS SPACE!

### 26 YEARS OF EXIDE SERVICE!

A GOOD EXAMPLE OF THE LONG LIFE OF THE EXIDE CONTROL BATTERIES COMES FROM THE LARGE WESTMORELAND SUBSTATION OF THE PHILADELPHIA ELECTRIC COMPANY. ONE 120-CELL EXIDE WAS INSTALLED IN DECEMBER 1927, ANOTHER IN FEBRUARY 1928. TWENTY-SIX YEARS LATER THE FIRST WAS REPLACED WITH A NEW, IMPROVED EXIDE-MANCHEX-THE OTHER BATTERY CONTINUES TO PROVIDE DEPENDABLE SERVICE! LONG DEPENDABLE SERVICE IS WHY EXIDES ARE YOUR BEST POWER BUY—AT ANY PRICE!



LET EXIDE HELP SOLVE YOUR SWITCHGEAR BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR BULLETIN 210-WHICH TELLS HOW BATTERIES ARE MOST EFFICIENTLY USED IN SWITCHGEAR OPERATIONS.

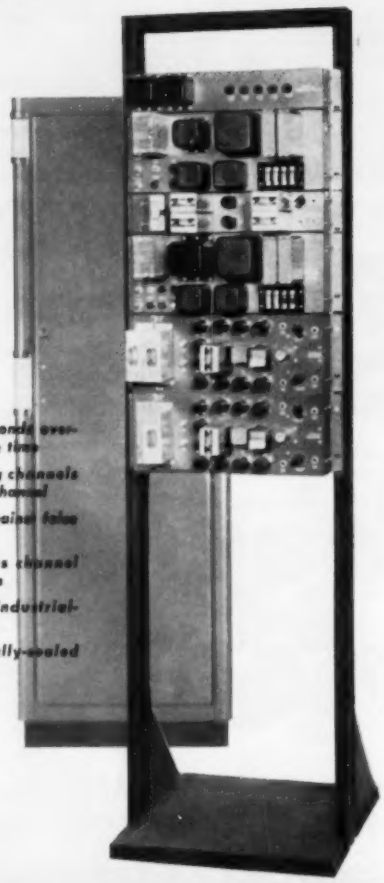
**Exide INDUSTRIAL DIVISION,** The Electric Storage Battery Company, Philadelphia 2, Pa.

# Motorola wide band VF carrier improves power line loading!

## ENABLES HIGHER BREAKER RECLOSING SPEED

Primary protection of power lines by transferred-trip protective relaying is now possible with a new type voice frequency carrier equipment developed by Motorola. This new *wide band* VF carrier provides high-speed transmission of tripping information between terminals, enabling *all* circuit breakers in a line section to be opened at the same time. Reclosing is much faster than possible with sequential tripping methods, greatly decreasing effects of line faults on system stability.

The equipment is designed to provide primary protection. *Reliability* in transmitting tripping information and *security* against false tripping have been proved by extensive tests of customer installations. A detailed description including performance specifications is contained in Technical Bulletin E-110. The Motorola Industrial Communications Engineer in your area will be glad to supply further information on this new power utility product.



- *10 milliseconds overall operate time*
- *4 relaying channels per voice channel*
- *security against false tripping*
- *continuous channel supervision*
- *long-life industrial-type tubes*
- *hermetically-sealed relays*

**Motorola Communications & Electronics, Inc.**
A SUBSIDIARY OF MOTOROLA, INC.
Dept. EW 4501 Augusta Blvd., Chicago 51, Illinois
Rogers Majestic Electronics Ltd., Toronto, Canada

Please provide more information on wide band VF carrier for protective relaying.

Name_____ Title_____

Company_____

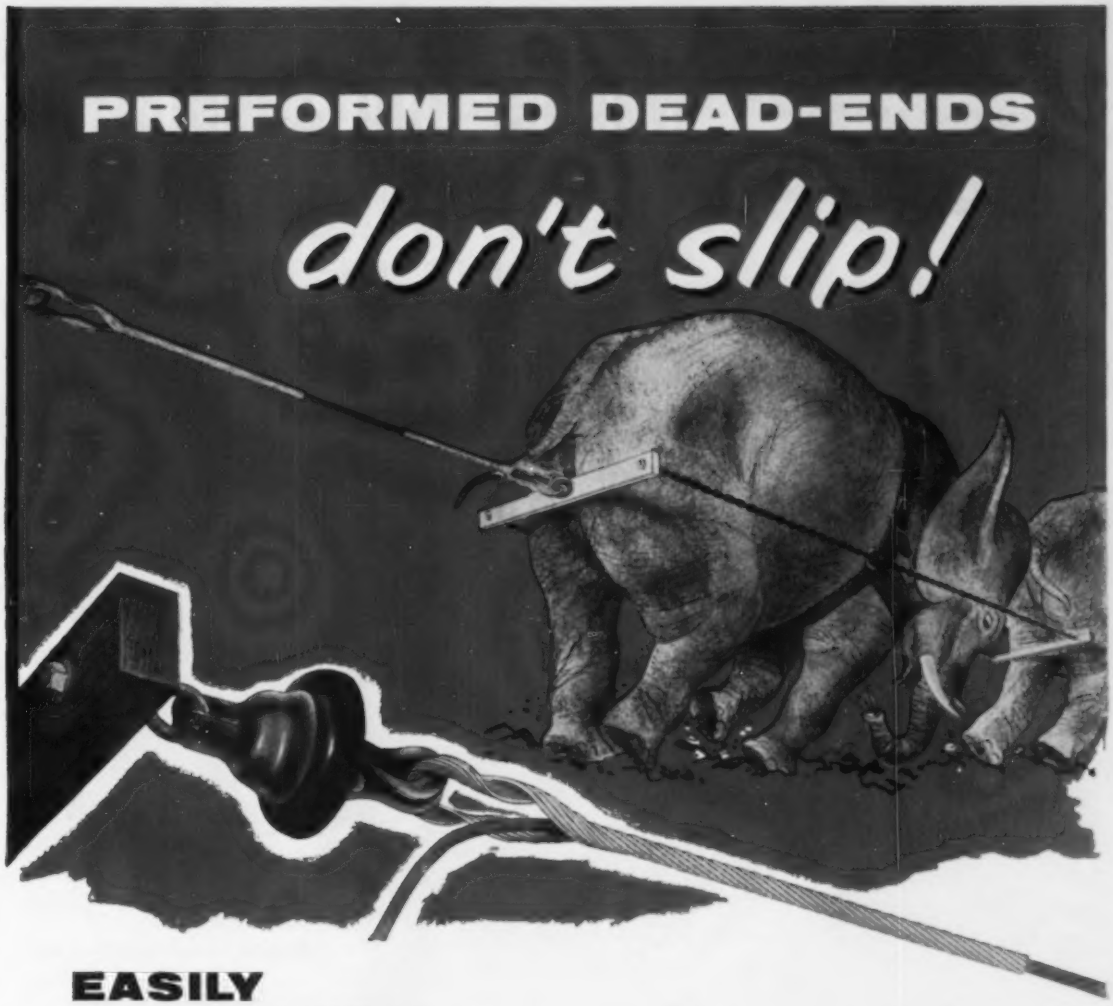
Address_____

City_____ Zone_____ State_____

**Motorola**

*complete supplier of communications and control equipment for the power utility industry: power line carrier, aperiodic coupling units, VF carrier, supervisory control, microwave relay, and 2-way mobile radio.*

# PREFORMED DEAD-ENDS *don't slip!*



**EASILY INSTALLED!** Guard against damaging high concentrated pressures at dead-ends . . . avoid outages with Preformed Dead-Ends. They firmly hold the conductor snugly and securely with a "velvet-glove" grip. Make them your standard dead-end for both insulated and bare conductors.

They are the easiest installed dead-ends you've ever used. Proved by extensive tests, both in the laboratory and in the field, Preformed Dead-Ends withstand tremendous strain even under constant intermittent loading conditions.

Prove to yourself that they are outstanding—both in service life and economy. Write or call for more facts. Telephone Cleveland: EX-1-3571.

PLP

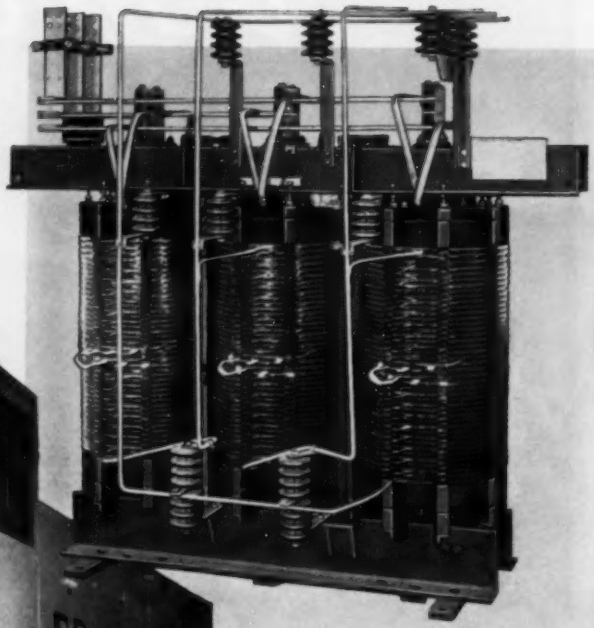
**PREFORMED LINE PRODUCTS COMPANY**

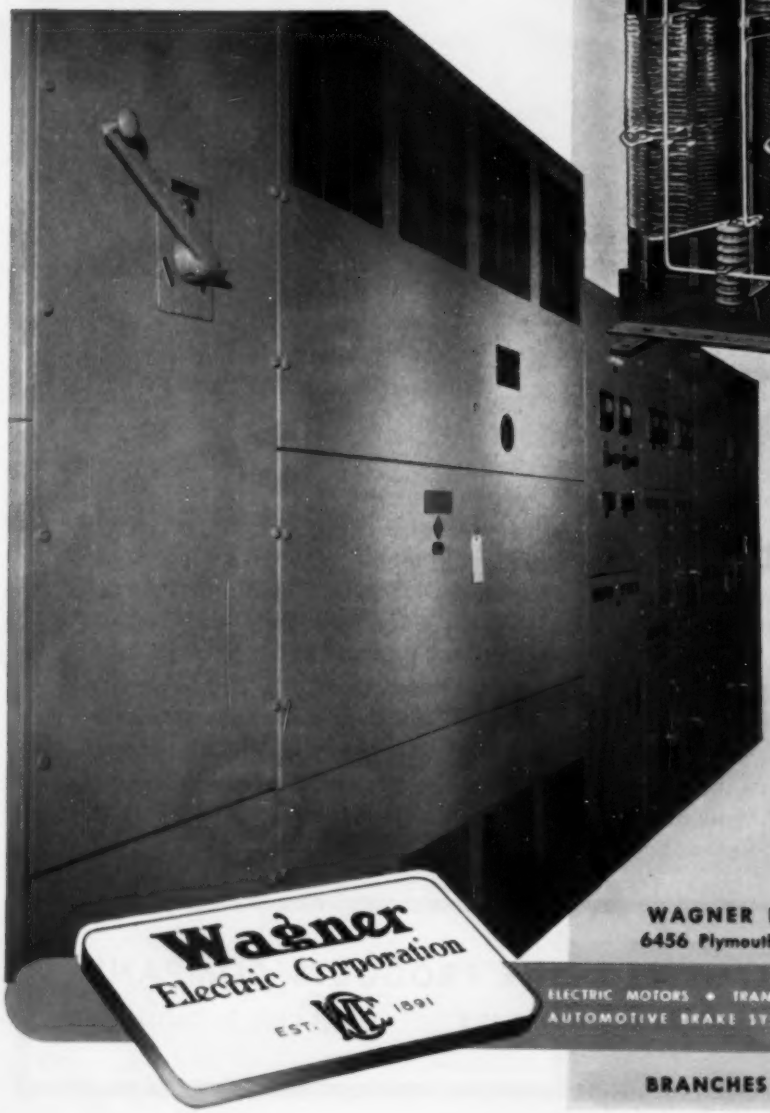
5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Wagner®
TRANSFORMERS
...the choice of leaders
in industry

# Wagner Unit Substation

The 2000 Kva, 4800 to 480 volt Wagner-equipped unit substation, shown below, feeds power to stamping operations for Packard. At right is shown a Wagner dry-type transformer like the one inside this unit substation.





## DRY-TYPE TRANSFORMERS

Wagner open, ventilated dry-type transformers are suitable for indoor use only. They are normally installed in a reasonably dry, dust-free atmosphere and in a well-ventilated location. Since they are light in weight, these transformers are often used in multi-story buildings. No fireproof vaults are required when you use Wagner dry-type transformers.

Wagner Electric Corporation
EST. 1891

**WAGNER ELECTRIC CORPORATION**
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

**BRANCHES IN 32 PRINCIPAL CITIES**

# Transformers help increase productivity at PACKARD

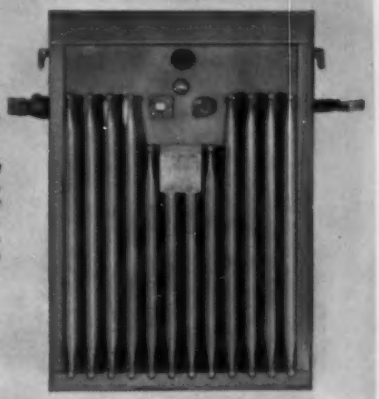
Packard's modernization program is big news for industry. Increased productivity such as Packard will obtain calls for a steady flow of electricity—the source of power for production. That's why you'll find a most modern unit substation electrical distribution system at Packard. Unit substations put power where it's needed at the right voltage for use. Wagner is part of this power picture at Packard. And Wagner unit substation transformers can answer your power needs just as they do at Packard.

## You can get a Wagner Substation Transformer *PREDESIGNED* to meet your needs

Wagner "Predesigned" Standard Unit Substation Transformers are carefully engineered to meet heavy industrial demands—they are not designed for minimum duty only. Predesigning completely eliminates individual job engineering time . . . reduces your costs . . . and permits quick delivery.

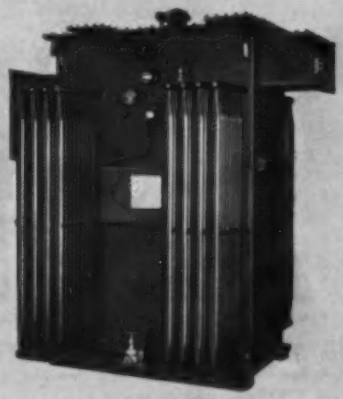
When you specify Wagner "Predesigned" transformers you get the advantages of a proved design in a completely assembled transformer, tested at the Wagner factory. They are built in standard ratings which are coordinated with the specifications of all unit substation builders.

Investigate the many advantages of specifying Wagner "Predesigned" Unit Substation Transformers for your next load-center installation. Consult the nearest of our 32 branch offices, or write for Wagner Bulletin TU-205. It gives full information on Wagner Unit Substation Transformers for industrial power distribution systems.



**NOFLAMOL CLOSE-COUPLED DESIGN**

Fits flush against switchgear enclosure, eliminating the throat and saving space. Available in ratings from 300 through 2000 Kva.



**LIQUID-FILLED**

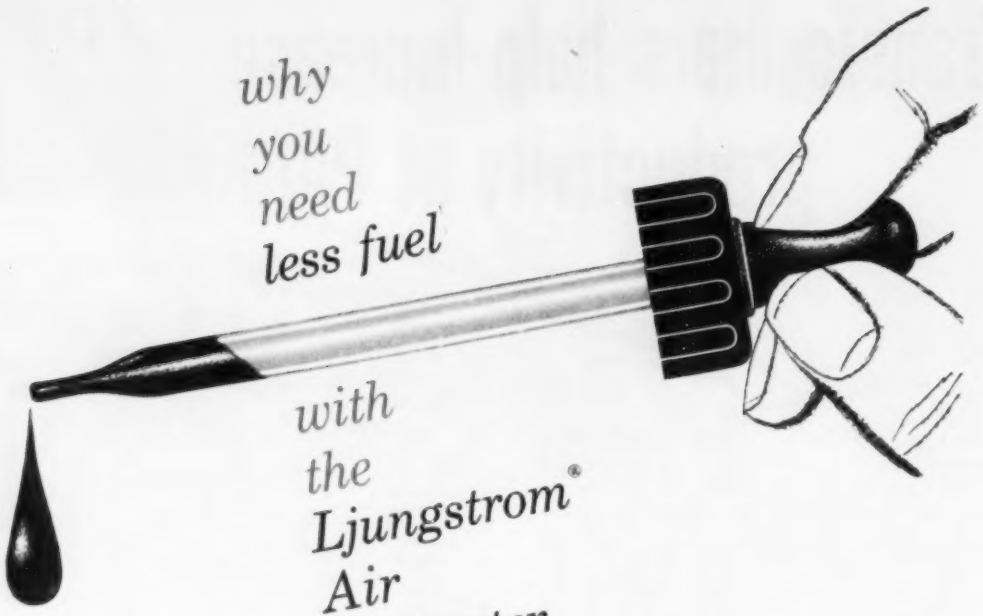
Noflamol transformers (non-inflammable liquid filled) for indoor or outdoor installation and oil-filled transformers, generally installed outdoors.

**NITROGEN-FILLED**

Sealed dry-type nitrogen filled transformers for indoor or outdoor installation—require only minimum maintenance—are completely fireproof. Ratings up to 2000 Kva.

T55-10

# *why you need less fuel with the Ljungstrom® Air Preheater*

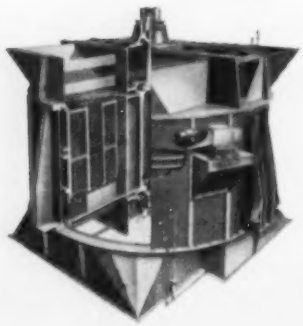


With every 45-50 F of air preheat — you cut your fuel bill 1%. That's why it pays to equip your boilers with Ljungstrom Air Preheaters. For the Ljungstrom is the most efficient air preheater there is.

***Advantages of the Ljungstrom Air Preheater***

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

The Ljungstrom also gives industrial plants broad latitude in their choice of fuels. Its unmatched preheating efficiency makes practical and effective such low-grade fuels as saw and paper mill refuse, wood, lignites, peat and bagasse.



Outright fuel economy is reason enough why 7 out of 10 modern preheater installations are Ljungstrom, and why Ljungstrom percentage of installed boiler capacity increases every day. Yet it's just one of the many advantages of the Ljungstrom. Get all the details on why the Ljungstrom cuts fuel costs . . . why it's the most efficient heating surface on the modern boiler . . . why it's easier to clean and maintain. All the details are in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for it, today.

**The Air Preheater Corporation** 60 East 42nd Street, New York 17, N. Y.

# New loss-of-field relay provides automatic protection of machine and system

When a synchronous machine loses its field, both the machine and system stability are seriously threatened. Low excitation can lead directly to thermal damage of the machine. In addition, the machine may go out of synchronism and draw sufficient reactive power from the system to upset system stability.

The new Westinghouse HLF relay protects both the machine and system. When low field conditions cause the machine to exceed its capability, an alarm is immediately sounded. Warned in time, the operator can take corrective measures without taking the machine off the line.

Should the system voltage drop to a point threatening system stability, a self-contained voltage element in the relay will immediately trip the machine.

All relay components are coordinated to prevent false tripping in event of low-voltage conditions alone, or external faults. The relay is adaptable to all types of synchronous machines without modification.

For the best in relays, rely on Westinghouse leadership in relay engineering. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40463

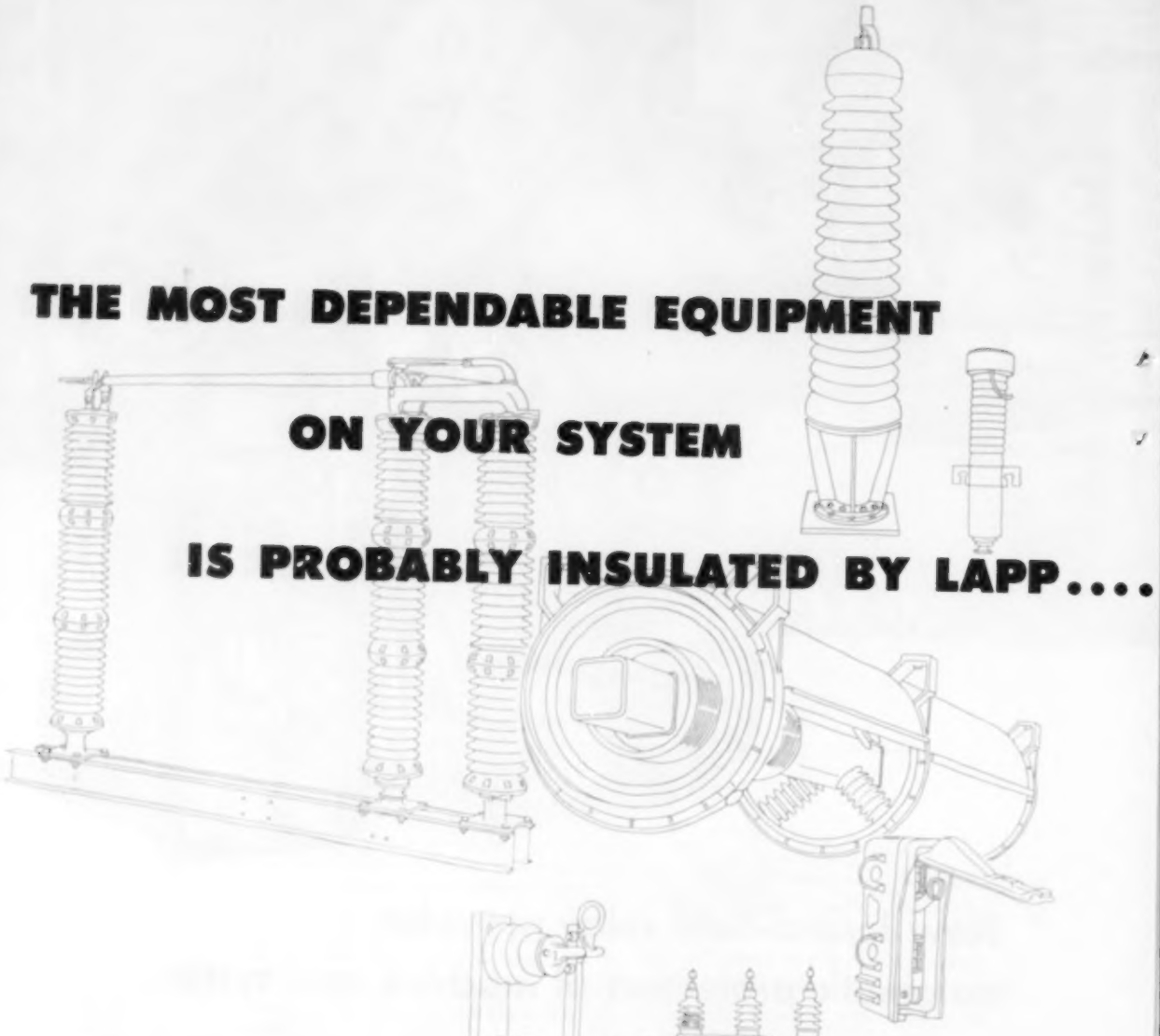
YOU CAN BE SURE...IF IT'S

Westinghouse

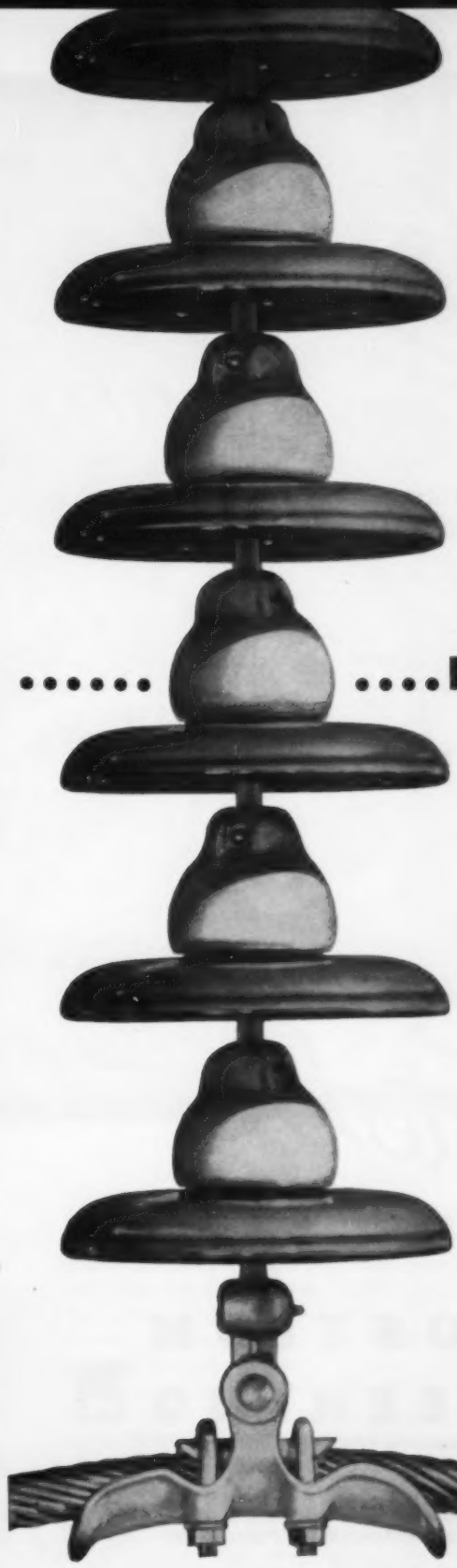
THE MOST DEPENDABLE EQUIPMENT

ON YOUR SYSTEM

IS PROBABLY INSULATED BY LAPP....



Lapp



## ..... ....HOW ABOUT YOUR TRANSMISSION LINES?

Manufacturers of the best in switches, transformers, lightning arresters, fuse boxes, and other high-voltage electrical equipment look to Lapp for insulators and "special porcelain" insulating components. That's because they know porcelain-and-metal assemblies produced by Lapp offer an extra margin of operating security . . . long life . . . and low upkeep. Lapp porcelain adds value, because it adds dependability, to such equipment.

The porcelain-and-metal assembly of which Lapp has made more units than any other, is the 10" suspension disc. This "simple design" has had more research and testing than anything else we have ever worked on.

We know, as do hundreds of power companies, that there's no surer way to build security and long service into a transmission line than to hang it on Lapp suspension insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.

**NEW UTILITY STATIONS C-E EQUIPPED**

*Includes only new stations on new sites placed in operation since the war (in white) and those under construction or being engineered.*

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA
HENNEPIN • EASTLAKE
OAK CREEK • SUWANNEE RIVER
URQUHART • KINGSTON
SANDOW • MULLERGREN
BARRY • NORTH OMAHA
WILMINGTON • CARBON

SAGUARO

**VERMILION**
**MORRO BAY**
**MILLIKEN**
**GALLATIN**
**JOHN SEVIER**
**BARRETT**

# NEW SAGUARO STEAM PLANT

*Soon to be dedicated*

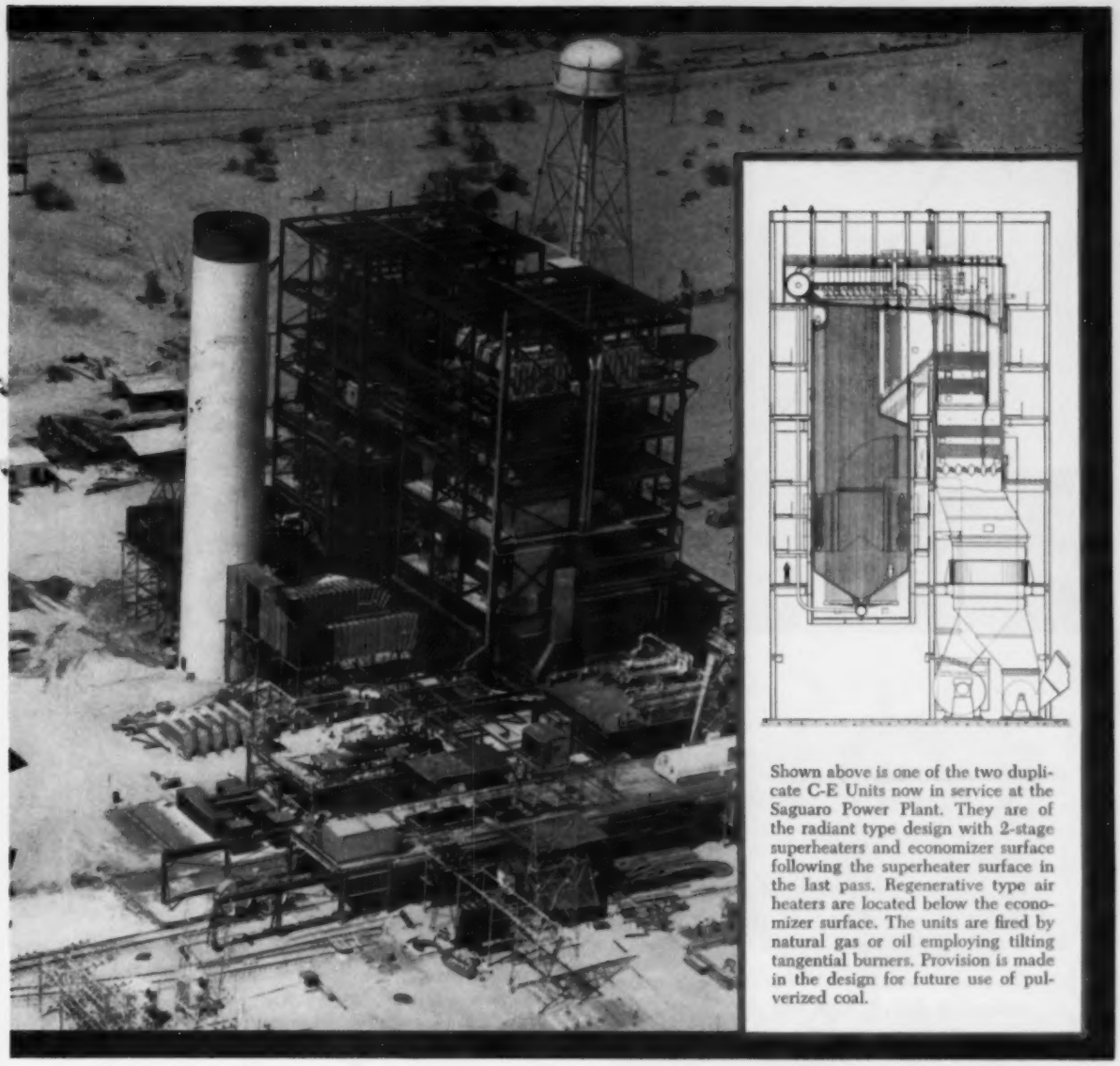
# COMBUSTION ENGINEERING

C-E

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

B-838

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE





Shown above is one of the two duplicate C-E Units now in service at the Saguaro Power Plant. They are of the radiant type design with 2-stage superheaters and economizer surface following the superheater surface in the last pass. Regenerative type air heaters are located below the economizer surface. The units are fired by natural gas or oil employing tilting tangential burners. Provision is made in the design for future use of pulverized coal.

Arizona's newest and largest steam-electric generating station, Saguaro Power Plant, has recently placed its second unit in service and plans are now under way for the formal dedication of the plant. The station became part of the Arizona Public Service Company system on July 1, 1954, when the first unit went on the line.

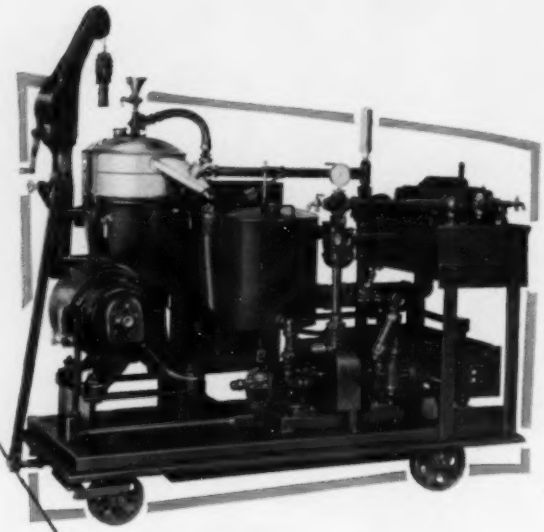
Comprising initially two 100,000 kw turbo-generators, the Saguaro Plant will supply sufficient power to serve the entire metropolitan area of the city of Phoenix. This is as much power as was used by the entire state as recently as 1942. Provision is made for two additional units of the same size — or larger — as may be indicated by future needs.

Located in Pinal County, 30 miles north of Tucson, this new plant is conveniently adjacent to a transcontinental highway, to a mainline railroad, and to cross-state gas transmission lines. It is a completely outdoor installation with the minor exception of walk-in enclosures over the ends of the turbo-generators. Ebasco Services, Inc. were the Consulting Engineers.

Steam for both generating units is supplied by C-E Boilers, a cross-sectional elevation and brief description of which is shown directly above. The boilers are designed for a maximum continuous capacity of 900,000 lb of steam per hr at a pressure of 1550 psi and a total temperature of 1005 F.

# THE BEST INSULATING OIL...

## IS ONLY AS GOOD AS YOU KEEP IT



You're particular about the quality of oil you buy for your transformers and circuit breakers...

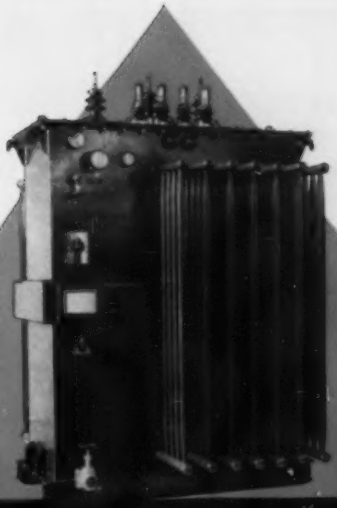
It's equally important to be just as particular about the method you use to keep it at high dielectric strength!

*De Laval Insulating Oil Purifiers* are *guaranteed* to deliver high test oil... *really* dry ... *really* clean. And they do this job with a single pass... at safe, low temperature!

Want to know *all* the reasons why the great majority of important power companies use De Laval Insulating Oil Purifiers? Write for Bulletin TR-1.

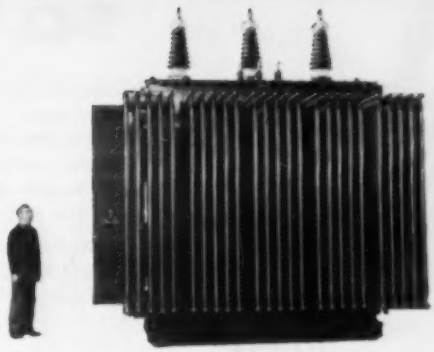
**DE LAVAL**
insulating oil purifiers

**THE DE LAVAL SEPARATOR COMPANY** Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5



# UPTEGRAFF POWER TRANSFORMERS

## PROMPT DELIVERY... FULLY GUARANTEED



A complete engineering department and a modern, fully-equipped plant give Uptegraff the facilities it takes to provide fast service on power transformer production—even those of special design.

Available in sizes up to 10,000 KVA, 115 KV, every Uptegraff transformer meets or exceeds ASA, NEMA and AIEE standards and is fully guaranteed by our company.

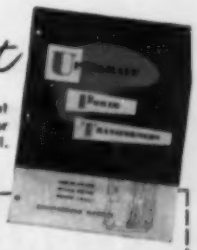
These two advantages are yours when you order Uptegraff transformers for your power needs. And when the unit is delivered and installed, you have one of the finest built pieces of electrical equipment in the country—rugged, leakproof, undercoated, and performance tested.

You can order Uptegraff Power Transformers with standard accessories; terminal arrangement, cooling fans, wheels, oversize bushings and many other special accessories are optional.

If you're getting ready to replace or add to your transformer installations, Uptegraff can serve you well and quickly.

*Send for Data Booklet*

Use coupon below or your letterhead and get this comprehensive ENGINEERING MANUAL for executives, engineering and operating personnel.



**R. E. Uptegraff Manufacturing Co.**
*Scottdale, Pennsylvania*

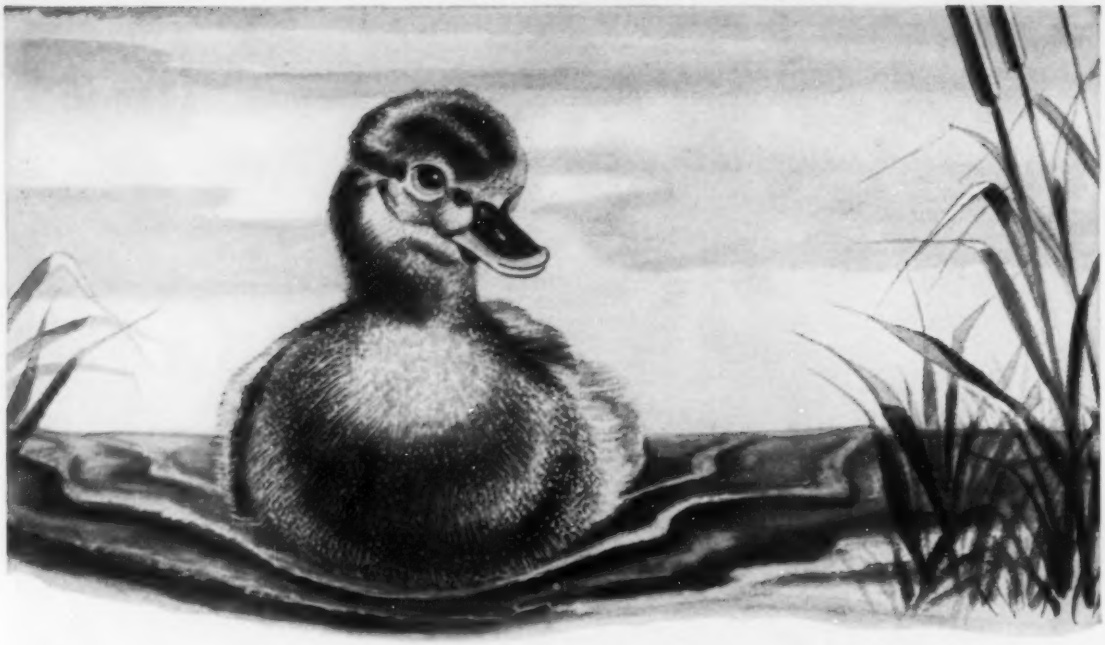
R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pa.

Name_____

Address_____

City_____ State_____

EW



# SO SMO-O-O-OTH!

ORANGEBURG NOCRETE

ORANGEBURG STANDARD

Orangeburg Conduit provides the protection that means *longer life* for your *cables . . .* at *minimum cost.* Its *smooth bore* and *low coefficient of friction* are safeguards against abrasion when cables *go in* and *after they are in.*

Long-lasting *cable* protection is further assured by Orangeburg's tough, strong, resilient material, which resists acids, alkalies, salt, grease, oil . . . and by its impermeable wall and tight joints that keep out corrosive ground waters.

*Cost-Saving Advantages!* Orangeburg is quick, easy and economical to install because of its light weight, long lengths, readily-assembled joints, and the angle couplings, bends and other standard fittings furnished by Orangeburg. No wonder Orangeburg is a leader among Public Utilities, Municipalities, Industries and Electrical Contractors everywhere. Send to Dept. EW-55 for more facts.

**ORANGEBURG MANUFACTURING CO., INC.**

**Orangeburg, N. Y. — West Coast Plant, Newark, Calif.**

**ORANGEBURG® FIBRE CONDUIT**

**STANDARD** INSTALLED WITH CONCRETE

**NOCRETE** INSTALLED WITHOUT CONCRETE

GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

# ALL NEW *type* MB-2

## 14.4 Kv AUTOMATIC CIRCUIT RECLOSER

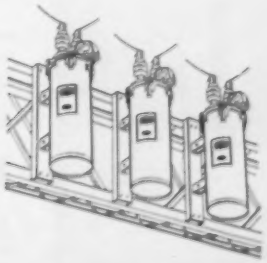
**OFFERING THE LATEST IN CIRCUIT PROTECTION FROM**

**R&IE**

**The *ONLY* Power Class Recloser with these exclusive features . . .**

1. **Fastest interruption** (1 cycle)
2. **Fastest restoration** (20 cycles)
3. **Highest continuous rating** (280 Amp.)
4. **Mechanical timing** (free of temp. error)

The new type MB-2 now offers the fastest circuit interruption of any relcoser. Other new important features include—optional time curves, faster inverse time, 110 Kv BIL bushing porcelain, safety lockout, large oil capacity, increased resistance to both arc wear and mechanical wear, universal tin-coated terminals, half-inch counter numerals, improved gasketing, lockout-free mechanism, and easy manual operation.



**Interrupting Capacities**

| Continuous Current Rating—Amperes | 4.8 Kv. | 7.2 & 14.4 Kv |
|---|---|---|
| 100 | 6000 | 4000 |
| 140 | 6000 | 4000 |
| 200 | 6000 | 4000 |
| 280 | 6000 | 4000 |

**R&IE EQUIPMENT DIVISION**
I-T-E CIRCUIT BREAKER CO.
**GREENSBURG, PA.**

STRUCTURES—steel or aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

DOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION

# Weed and Brush Control lasts longer with Du Pont TELVAR® and AMMATE®

**Weed Killers** — **Weed and Brush Killer**

"Telvar" has kept this yard clean of vegetation for two years.

Note thorough job "Telvar" did around this fence. "Telvar" won't corrode fence or equipment; it's non-flammable, non-volatile.

Heavy weed growth around pole was controlled with one application of "Telvar." It's easily applied and extremely low in toxicity to humans and animals.

**One application of "Telvar"** solves weed problems for a season or longer!

"Telvar" kills through the roots . . . prevents regrowth. Low dosages (20 to 80 lbs. per acre) make it cost little for the results you obtain. Low rates also mean less handling, less storage facilities. If you're looking for a way to cut maintenance costs to new low levels, include "Telvar" in your weed-control program. Available in two formulations: "Telvar" W; and "Telvar" DW, which is especially suited for light, sandy soils and in areas where annual rainfall is higher than 20 inches.

**"Ammate" kills more kinds of brush** and keeps it down longer than most weed and brush killers!

When the original spray job is well done, brush is kept under control with nothing more than an occasional spot spray later. You can rely on "Ammate" to do the job safely, even where your rights-of-way adjoin crop land, because "Ammate" is not volatile. There are no vapors to drift onto sensitive crops.

**FREE ILLUSTRATED BOOKLETS** describe how to control weeds and brush with Du Pont chemicals. For your copies, write to Du Pont, Grasselli Chemicals Dept., Rm. D 4038, Wilmington, Del. In Canada—Du Pont Company of Canada Limited, Montreal, Box 660, Canada.

**TELVAR®** Weed Killers — **AMMATE®** Weed and Brush Killer

*On all chemicals always follow directions for application. Where warning or caution statements on use of product are given, read them carefully.*

DU PONT

REG. U.S. PAT. OFF.

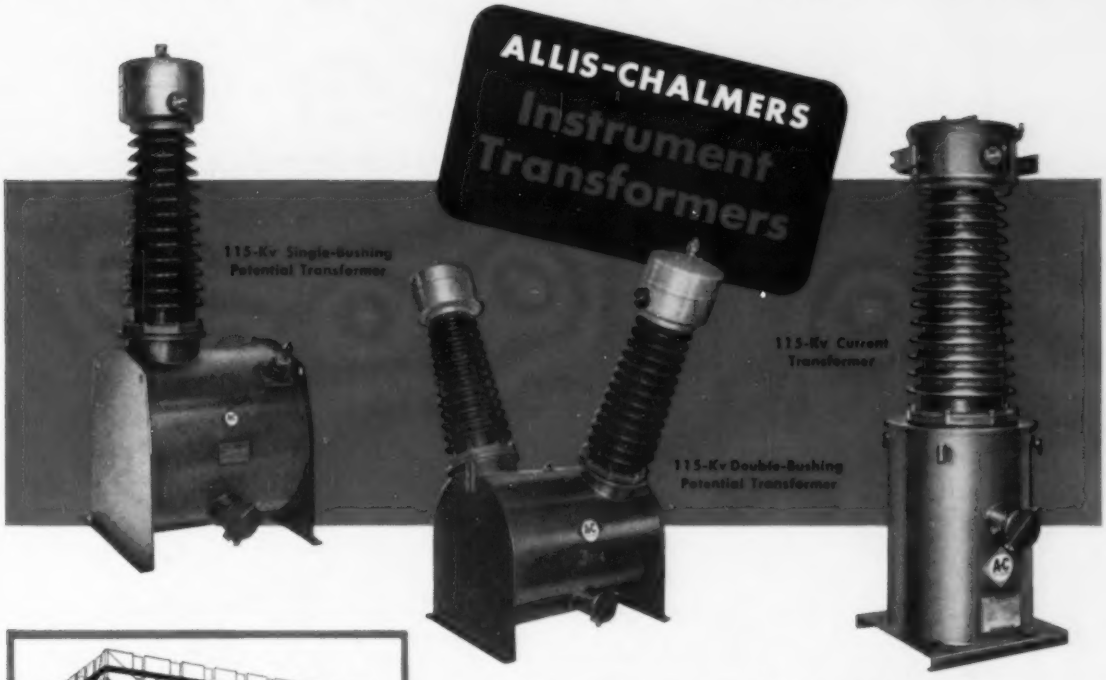
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

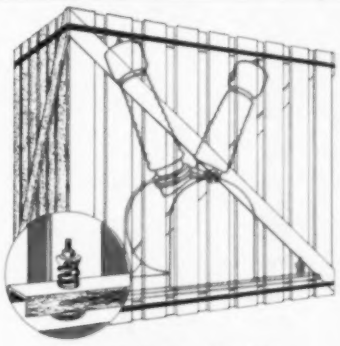
"Ammate," applied five years ago, is still keeping brush down along this right-of-way.

Maintenance crews prefer "Ammate" because they can use it without hazard to themselves, livestock, wildlife or adjoining crops.

Same right-of-way as above, three years after treatment. Brush still under control; low-growing cover returned to resist erosion.

# New, compact, lightweight design extended to higher voltage classes



**Shipped on Springs for Maximum Protection**

During shipment, each Allis-Chalmers large current or potential transformer floats on springs in a specially designed crate. Result: maximum protection against damage en route. Assurance that you will get a unit in top condition ready for service.

NOW YOU CAN TAKE ADVANTAGE of Allis-Chalmers new designs for oil-insulated outdoor current and potential transformers for circuits through 115 kv. They take less space, require less foundation or mounting structure than older designs. They are easier to handle during installation.

### Corona-Free Design for Long Life

All units in the line are corona-free. They utilize solid insulation at critical points to reduce stresses and lengthen life. Extensive internal overvoltage tests have proved all voltage classes.

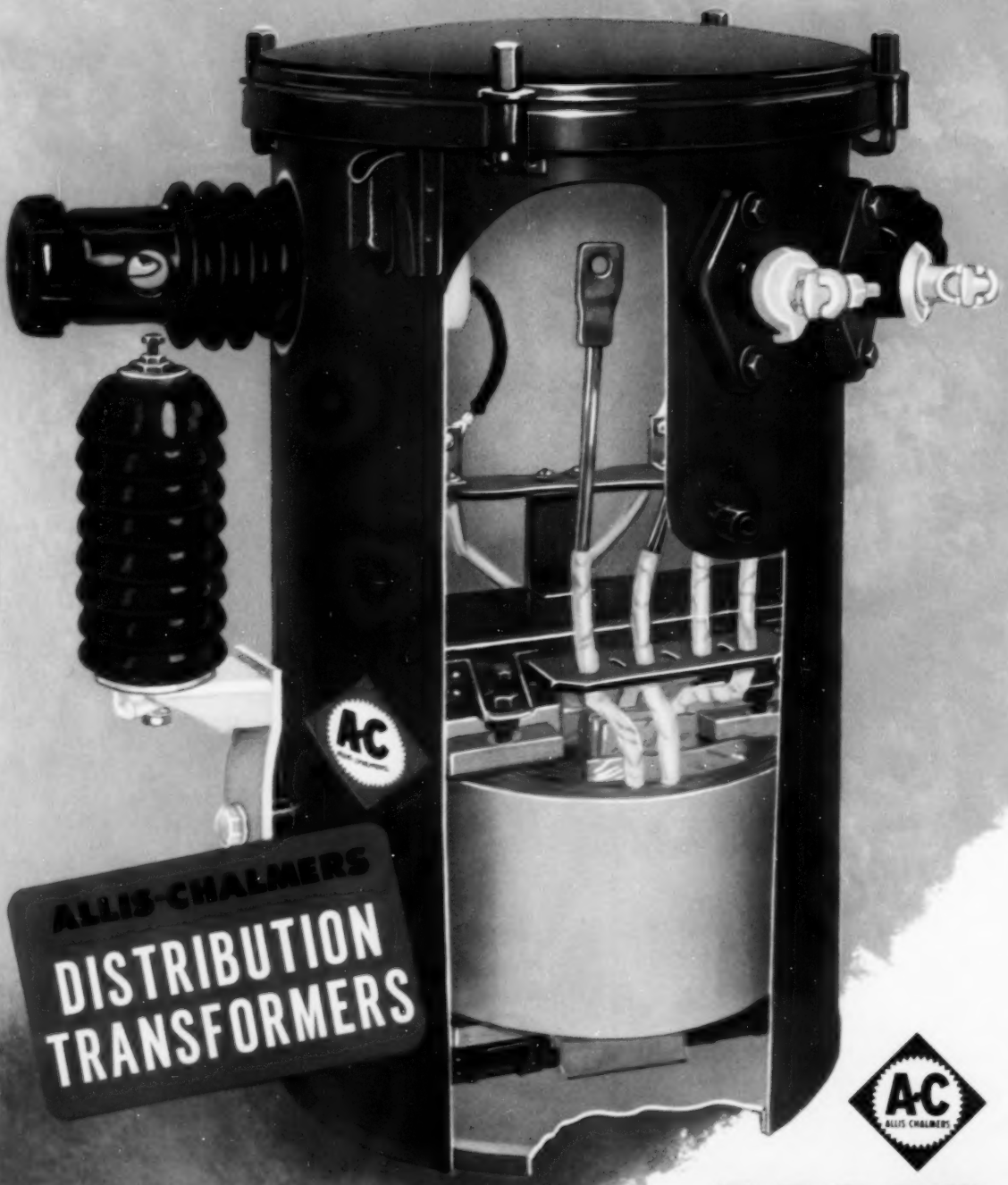
### Sturdy Construction

Tanks are all-welded, hermetically sealed to protect insulation and oil from sludge formation. Unique bushing construction provides for an oil reservoir common to both bushing and transformer, reducing the oil requirements and cutting the size and weight.

Get more information by calling your nearby A-C district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for your copy of "PT's Are Getting Smaller." A-4544

# ALLIS-CHALMERS

# Which Distribution




A-C
ALLIS CHALMERS

**ALLIS-**

# Transformer Is Best?

*Check these*
**6 FEATURES**
*...then decide for yourself*

### NEW HIGH VOLTAGE SIDEWALL BUSHING

Simplifies installation; assures reliability. No more splicing because connector grips two standard conductors as large as No. 2 stranded cable at same time. Safety-designed hand-knob can't be unintentionally removed, positively protects against touching "hot" parts. Use either copper or aluminum conductor. Serrated ram prevents conductor twisting or slipping. Follow-up spring maintains positive contact pressure. No metal-to-porcelain contact at any point. Retained Corprene gaskets. Simplified bushing cable connection to terminal board makes maintenance easy.

### NEW LOW VOLTAGE BUSHING

Double key design gives positive protection against rotation, eliminating a major possibility of internal short circuit and maintaining effectiveness of seal. Connector stud is keyed to bushing porcelain. Bushing is keyed to tank wall. Connector and stud are one piece. Corprene gaskets are fully retained, are compressed without twist or shear. Tinned clamp-type connectors permit use of either copper or aluminum.

### NEW TANK AND COVER DESIGN

Machine welding throughout. Tapped lugs welded to tank surface so that internal thread is not exposed to damage. Tank bottom is recessed with straight wall inside and out — no place for condensation or water to collect. Cover and tank have horizontal gasket surface to assure proper compression of gasket with no possibility of shear. Gasket is fully retained. Cover clamps are captive, will not drop to ground when loosened. All tanks are pressure-tested at 50 psi.

### NEW COIL SUPPORTS

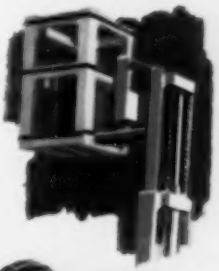
Coils are locked firmly in position with adjustable-type coil supports. Pad under support distributes pressure evenly. Pads are specially compounded alkyd polyester impregnated glass fiber for strength.

### NEW HOT SPRAY PAINT PROCESS

Allis-Chalmers exclusive hot spray paint process assures maximum protection under all conditions because it puts paint, not solvent, on transformers. As a result, you get an even flow of high content, specially developed alkyd resin enamel that provides a smooth surface with high gloss and thorough coverage.

### NEW SHIPPING CRATE IS RE-USABLE PALLET

Now Allis-Chalmers distribution transformers are shipped in a pallet-base crate that simplifies storage and provides a convenient pallet usable on other materials after transformer is uncrated.



### SEE FOR YOURSELF

All these features and more are conveniently, graphically explained and demonstrated in the "Allis-Chalmers Visualizer." Call your nearby A-C district office and ask to see it. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more information.

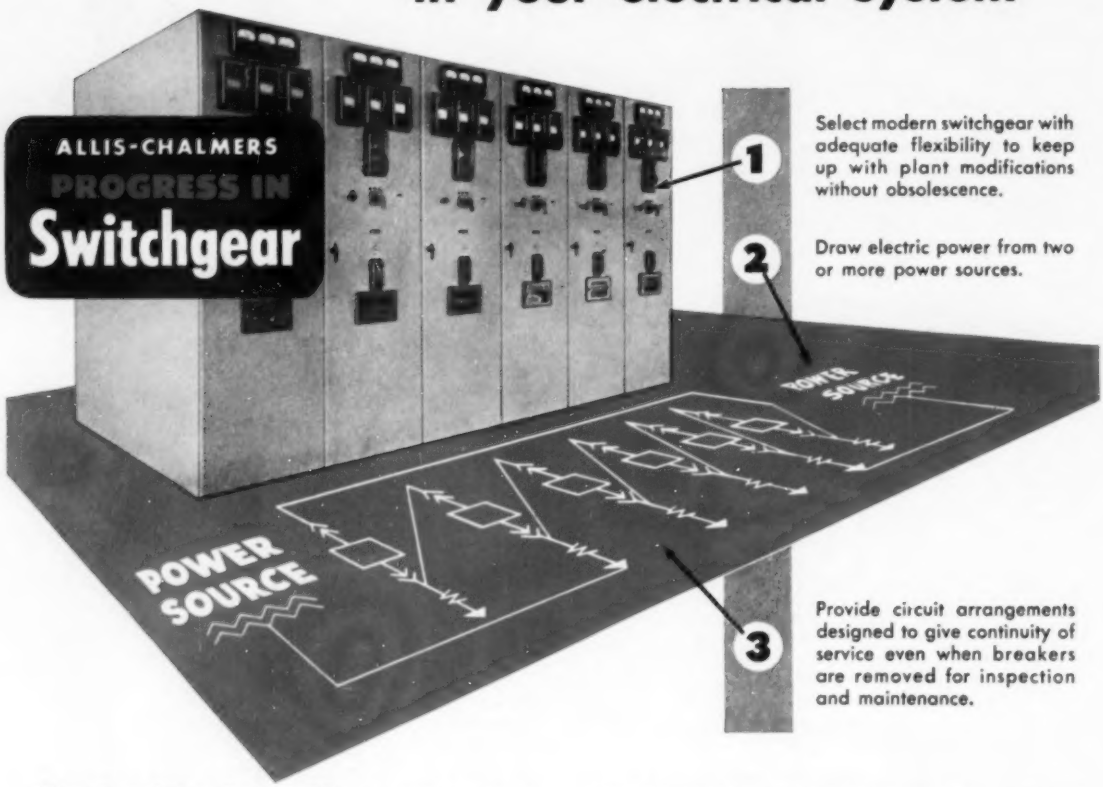
A-4531

# CHALMERS

# For uninterrupted power . . .

# combine these 3 features

## in your electrical system




Select modern switchgear with adequate flexibility to keep up with plant modifications without obsolescence.

Draw electric power from two or more power sources.

Provide circuit arrangements designed to give continuity of service even when breakers are removed for inspection and maintenance.

**The 3 points above offer** a simple rule of thumb for planning an electrical system that will provide uninterrupted power.

Key to the operation of such an electrical distribution setup is the switchgear. Allis-Chalmers has specialized in this type of switchgear engineering and offers these advantages to the user:

**SAVES SPACE** — Allis-Chalmers switchgear compartments are designed with room to permit adding special transfer bus or ring bus arrangements without adding auxiliary cubicles.

**SAVES COST** — No matter whether you eliminate duplicate facilities or simply eliminate extra cubicles, there is a substantial cost saving with Allis-Chalmers switchgear.

**SAVES TIME** — Allis-Chalmers dry-type bus joint insulation makes it easy to add or remove switchgear cubicles. No insulating compounds to melt . . . no fuss . . . no muss.

GET COMPLETE INFORMATION on Allis-Chalmers switchgear designed to meet needs for continuous power. Call your nearby Allis-Chalmers office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4422

Ask for these booklets:

- ☐ Primary Switchgear Arrangement for Chemical Plants.
- ☐ Continuity of Service at Distribution Voltages by Means of Ring Bus.
- ☐ Design Considerations of Switchgear for Pipeline Substations.

A-C ALLIS-CHALMERS

# ALLIS-CHALMERS

# *New* CONGESTION-FREE MICROWAVE SYSTEM

## Now offered You by RCA for the Uncrowded 2450-2700 mc Band

If you've hesitated about Microwave because of any concern about spectrum congestion in certain areas, you'll welcome news about RCA's revolutionary MM-26. First to operate in the uncrowded 2450-2700 megacycle portion of the microwave spectrum, this new system, *offered only by RCA* means:

### NO CONGESTION—PEAK DEPENDABILITY

No perplexing engineering problems to solve in getting your system oriented. And your system won't be subject to interference from systems now in operation, thus providing all-time reliability. Single side band suppressed carrier frequency division multiplex is used exclusively to meet highest standards of dependability.

### PROTECTION AGAINST OBSOLESCENCE

Available frequency space is utilized most efficiently, offering more systems in one band, thus giving added protection against obsolescence—a major economic advantage. The new system can feed into existing RCA systems and so be added to your present equipment.

### HIGH SIGNAL-TO-NOISE RATIO

Up to 30 high-performance voice channels of famous RCA quality, or several hundred teletype and signalling channels are provided in one system. You get high signal-to-noise ratio, clearer telephone conversations, less distortion, less cross talk. You can expect better voice channel performance, dependable telemetering and facsimile, all-weather performance.

### "BUILDING-BLOCK" ADAPTABILITY

RCA's 12 basic units are readily interchangeable, which means you can put together a wide variety of stations, each designed to provide a specific combination of facilities. You get equipment exactly to your specifications, each combination being clearly explained on catalog sheets. Integrated operation of all units assures convenience and versatility in system planning, uniformly high performance.

### EASY INSTALLATION—SERVICING

Conventional triode tubes, unregulated power supply, familiar circuits, obviate the need for specially trained personnel. Tuning is simplified because the frequency is controlled from the terminal through the entire system.

*Microwave is today's most modern form of radio for private communications systems. A radio beam carries communications and control signals from one place to another, following a narrow line-of-sight path. RCA was one of the first to pioneer in Microwave. Today its installations cover the nation and the globe. Only RCA systems provide so many advanced engineering features. Microwave specialists will be glad to answer any questions and plan your installation. Mail Coupon below for further particulars.*

New stylized racks with doors feature modern functionalized design and open back for ease of servicing. Open cabinet shows complete Microwave Terminal. Closed rack shows stand-by equipment.

RCA

**RADIO CORPORATION of AMERICA**

COMMUNICATIONS EQUIPMENT
CAMDEN, N. J.

**Radio Corporation of America**
**Communications Equipment**
**Department R-45, Building 15-1, Camden, N. J.**

Please send me new booklet on RCA MM-26 Microwave—a system for the uncrowded 2450-2700 mc band, designed for pipelines, utilities, railroads, turnpike, common carrier.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

☐ Have an RCA Representative get in touch with me.

# How to meet utility load growth the easy way

***By installing Electro-Mobile Power right at any new point of need, you will—***

1. Escape new high-line cost entirely.
2. Postpone—or avoid—expensive additional generating station capacity.
3. Be paying no fixed charges for surplus capacity.
4. Have minimum line loss.

Rail car, truck trailer and portable units—350 to 1,000 kw.

Write for simple formula explaining investment advantages of Electro-Mobile Power to:

## ELECTRO-MOTIVE DIVISION

**GENERAL MOTORS • LA GRANGE, ILLINOIS**

Sold and serviced directly through a manufacturer's organization. Electro-Motive Division offices located in: New York City, Chicago, Jacksonville, St. Louis and San Francisco.

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario

# Nicopress SLEEVES for A·C·S·R·

## WILL GIVE YOU PEAK PERFORMANCE!

COMPLETED LINE SPLICE

Nicopress splicing unit consists of a steel sleeve for core wire and an over-all aluminum sleeve.



COMPLETED JUMPER SPLICE

REPAIR SLEEVE
(Partially Completed)

*Nicopress* is the Registered Trade Mark of The National Telephone Supply Company

**The National Telephone Supply Company**

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

*Canadian Mfr.*—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

*Export Distributor*—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

# M. W. KELLOGG WELDING TECHNIQUES KEEP PACE

As supercritical pressures and temperatures are put to work more and more in improving the economics of steam-electric plants, supercritical engineering and workmanship are demanded of the welding techniques for main and reheat steam piping.

At M. W. Kellogg, one of the many ways by which the company's power piping fabrication keeps pace with steam boiler and turbine designs is K-Weld* . . . a unique inert gas shielded arc welding technique that assures complete penetration and a highly uniform internal contour *without the use of backing rings.*

No welding problem in the shop or field is too tough for K-Weld. Developed through M. W. Kellogg's initial work on thin-walled stainless steel rockets, K-Weld safeguards the vital link between boilers and turbines in steam-electric central stations throughout the U.S. and Canada. Write for particulars. K-Weld's indicated uses in nuclear plant applications also warrant your investigation.

**FABRICATED PRODUCTS DIVISION**

**THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.**

*The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corporation, London*

SUBSIDIARIES OF PULLMAN INCORPORATED

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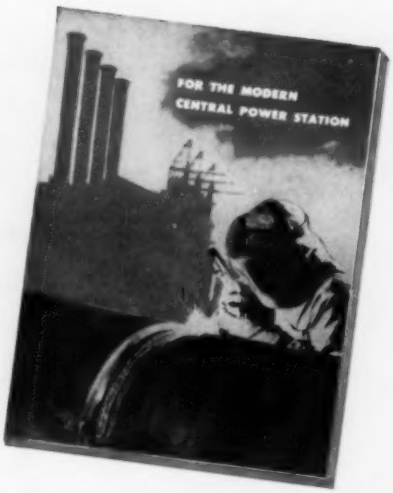


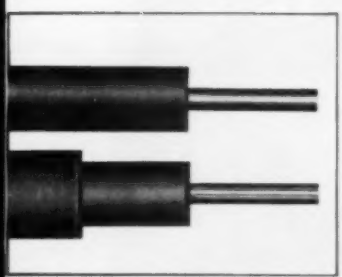

This 12-page booklet describes K-Weld in detail as well as M. W. Kellogg's other facilities for serving the power piping needs of modern central stations.

**POWER PIPING—THE VITAL LINK**

**Anaconda Plastic Series Lighting Cable** can be laid with tractor-mounted trench digger . . . with the trench immediately backfilled.

**15 minutes later** — same spot — photograph illustrates speed of installation. Anaconda cable gives maximum reliability for direct burial installation.

# If you're going to bury it—be doubly sure with Anaconda quality



**Three plastic types to choose from:** polyethylene insulation plus Densheath (PVC) jacket; or all polyethylene or all Densheath.

Winter thaws and freeze-ups and summer rains can be forgotten when you use ANACONDA Plastic Series Lighting Cable. This cable—engineered for direct burial, duct or overhead installation—is unaffected by moisture, soil chemicals, sun and weather.

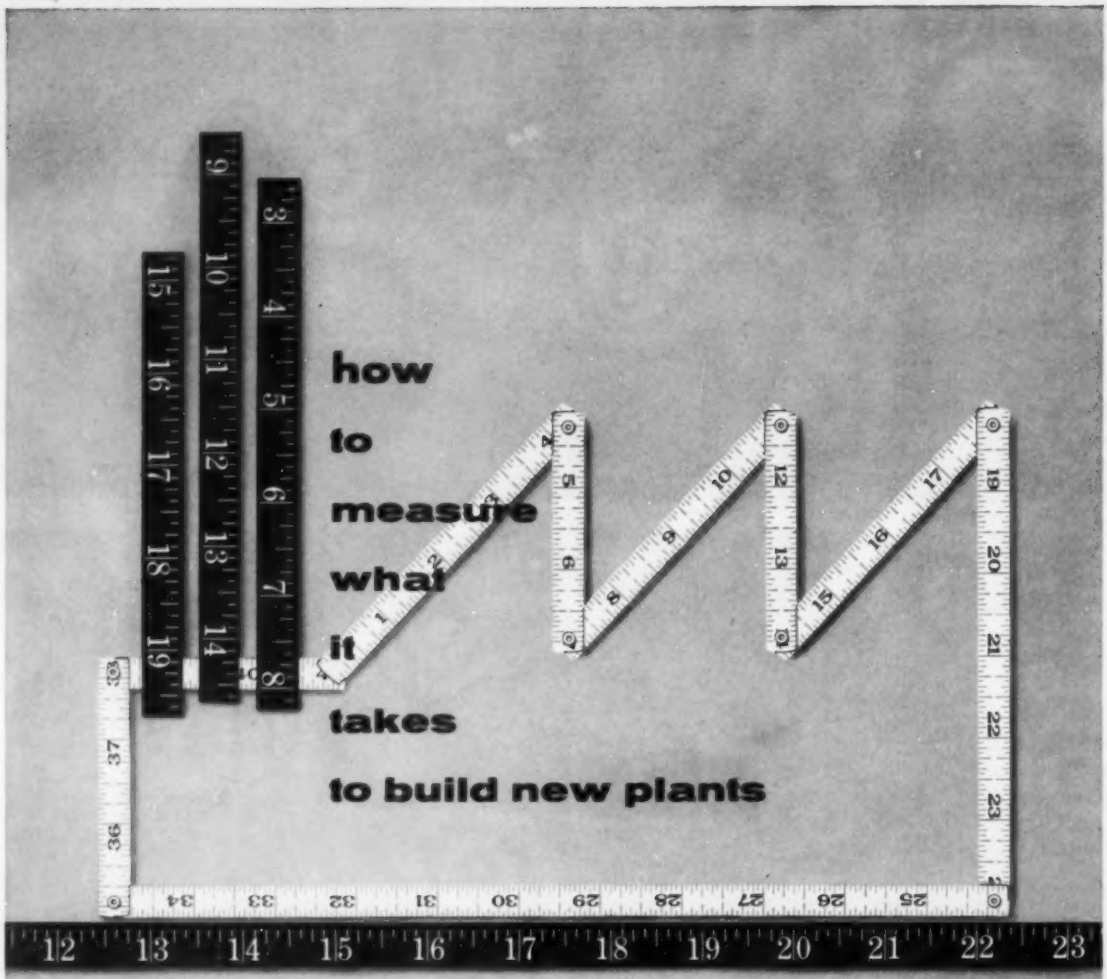
Anaconda Series Lighting Cable is available with either tough Densheath* (PVC) or Polyethylene compound, or both, for 3000 or 5000 volt applications. Plastic series cable has small O.D.'s and is easily handled.

For full information, send for Anaconda's new Street Lighting Cable bulletin: DM-5345.

**REMINDER:** ANACONDA Plastic Pole and Bracket Cable delivers the same fine service in its job as ANACONDA Series Lighting Cable does in its. Buy *both* for assured dependability—from beginning to end. Just see the man from Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 65305

*Reg. U. S. Pat. Off.

**ANACONDA®**
**POWER CABLES**




Most ingredients that go into a new plant can be measured by feet or yards, pounds or tons. But there are other things—far more important—that physical yardsticks can't size up.

*Experience*, for example. Ebasco experience spans half a century, and includes the engineering and construction of more than two billion dollars of plants in the United States and abroad.

*Skill and integrity* are evidenced in each phase of an Ebasco project. Ebasco's highly qualified technical skill is utilized in every part of the work—from site selection and preliminary planning, through finished construction, to successful operation.

Together these unseen elements add up to *quality* construction, the common denominator of every plant built by Ebasco.

If you are considering a new plant, write for our booklet, "The Inside Story of Outside Help". Address: Ebasco Services Incorporated, Two Rector Street, New York 6, New York.

EBASCO

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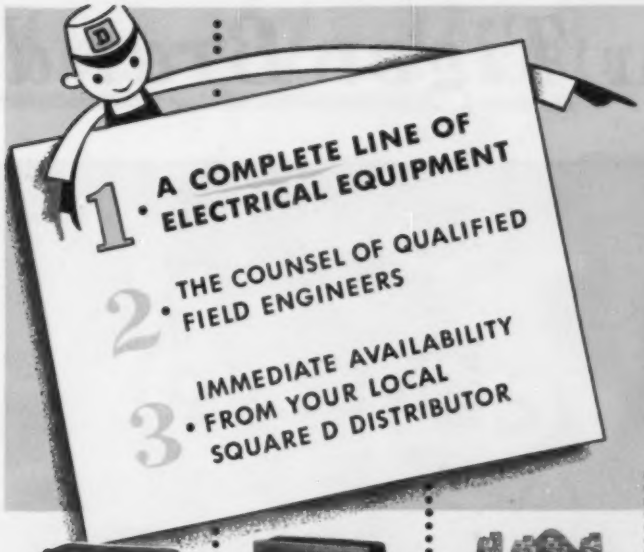
*Ebasco Teamwork gets things done anywhere in the world*

Appraisal · Consulting Engineering · Design & Construction · Financial & Business Studies · Industrial Relations · Insurance, Pensions & Safety
Purchasing, Inspection & Expediting · Rates & Pricing · Research · Sales & Public Relations · Space Planning · Systems, Methods & Budgets · Tax · Washington Office



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2 • THE COUNSEL OF QUALIFIED FIELD ENGINEERS

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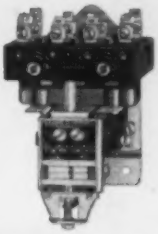
# SQUARE D GIVES YOU ALL 3!

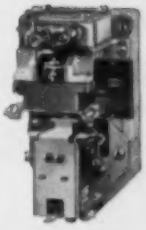
Magnetic Starters

Safety Switches



Control Relays

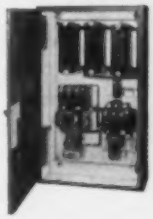
Fractional HP Starters



Timing Relays

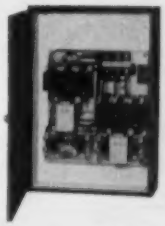
Combination Starters

Panelboards



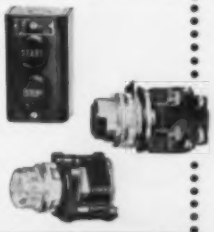
Primary Resistance Type Starters

Auto-Transformer Type Starters



Part Winding Type Starters

Wireways and Busways



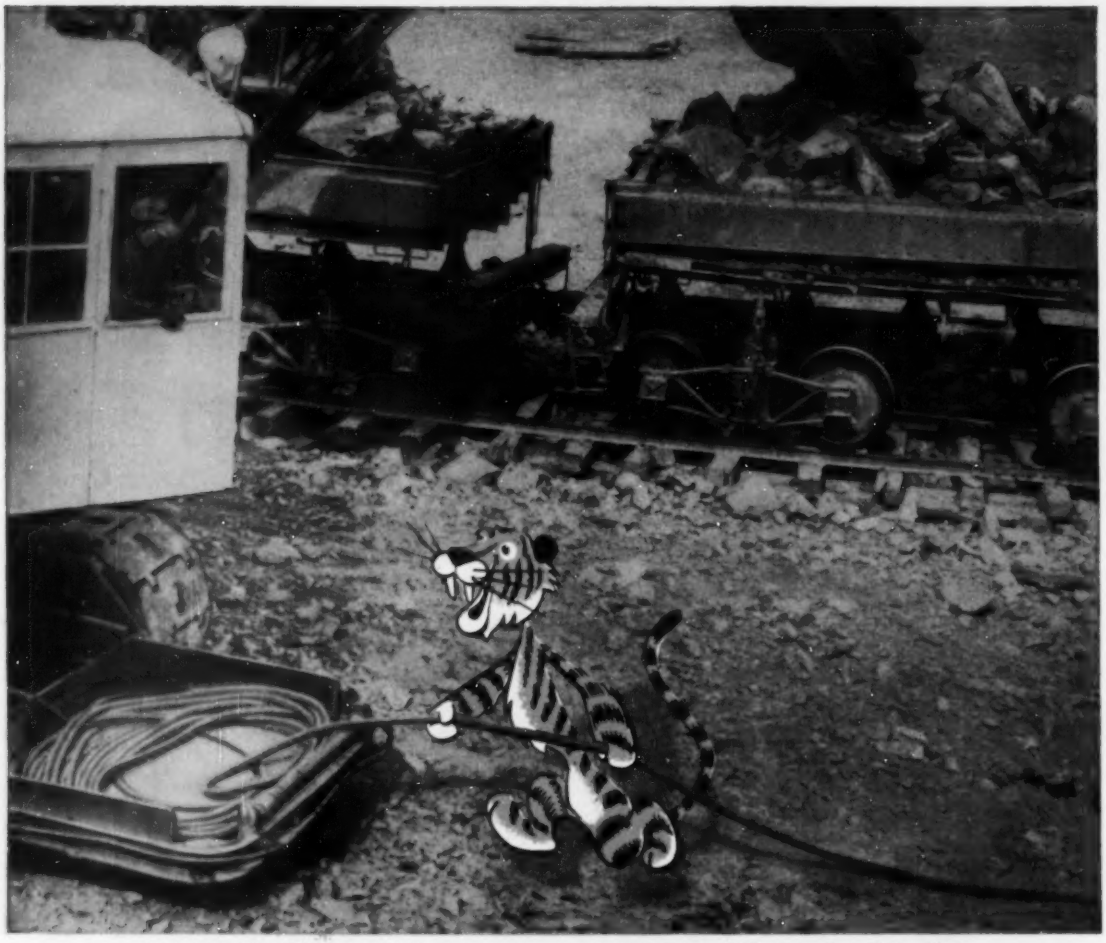
Pushbuttons and Accessories

• You name the air-conditioning job—Square D has the right electrical equipment for it—from the smallest residential installation to the largest commercial or industrial job through 200 HP at 440 volts.

*ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS*

SQUARE D COMPANY

# "Our *Tiger Brand*



**NOTICE THE CABLE TRAY** fastened to the shovel. This was developed by Universal Atlas for easier cable handling.

**TWO WORKMAN WATCH** from blast shelter as charge is set off in distance. Low horses cushion cable from shock of falling rock.

**HERE A CABLE** is raised on horses to clear the railroad track. It feeds the shovel visible in background.

# *Amerclad* lasted 12 years"

**Says Chief Electrician, Hudson Plant**
***Universal Atlas Cement Company***

Year after year, at this quarry, the Amerclad is exposed to knife-sharp fragments of flying rock. During the summer, the rock often gets so hot that you can't even touch it. Other times, the cable lies out in the rain and snow—often at sub-zero temperatures.

At the Hudson, N. Y. quarry of Universal Atlas, Chief Electrician Frank Rodmond said, "This Amerclad runs the constant danger of being hit with flying rock fragments through secondary blasting. Yet the down-time cost of this operation is so high that we just can't stand cables that keep failing. We kept that last batch of Amerclad 12 years before we replaced it, yet it was still serviceable when we switched over to new Amerclad."

If you want service like this, specify Amerclad the next time you need cable that can really take it. Amerclad is available in a great many sizes and constructions, with or without shielding. There is a type to power anything from a river dredge or mine locomotive down to a rough and tumble electric hand drill. *Send the coupon,* and get more information.

**AMERICAN STEEL & WIRE DIVISION**
**UNITED STATES STEEL CORPORATION**
**GENERAL OFFICES: CLEVELAND, OHIO**
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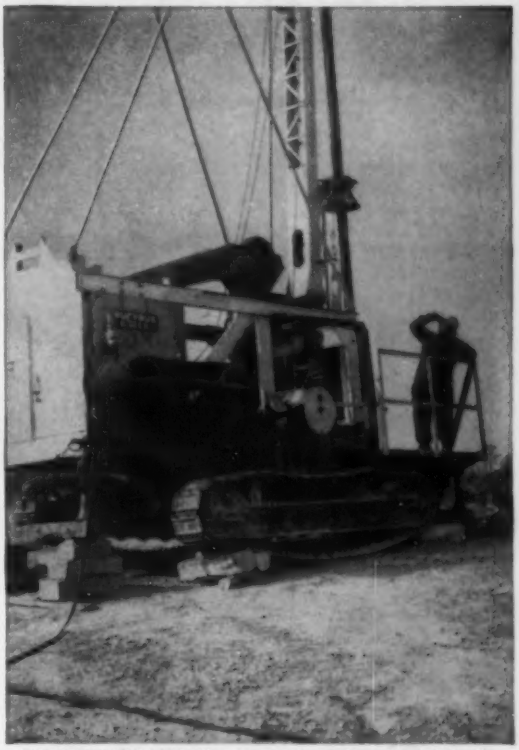


**THIS IS A TYPICAL DRILL.** It uses a 4-conductor No. 8 Amerclad cable.

## A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

paper & varnished cambric cable
asbestos wire and cable
aerial, underground & submarine cable
mold cured portable cord
machine tool & building wire
special purpose wire & cable
shovel & dredge cable

—SEND THE COUPON—

American Steel & Wire Division
Room EE-55, Rockefeller Building
Cleveland 13, Ohio

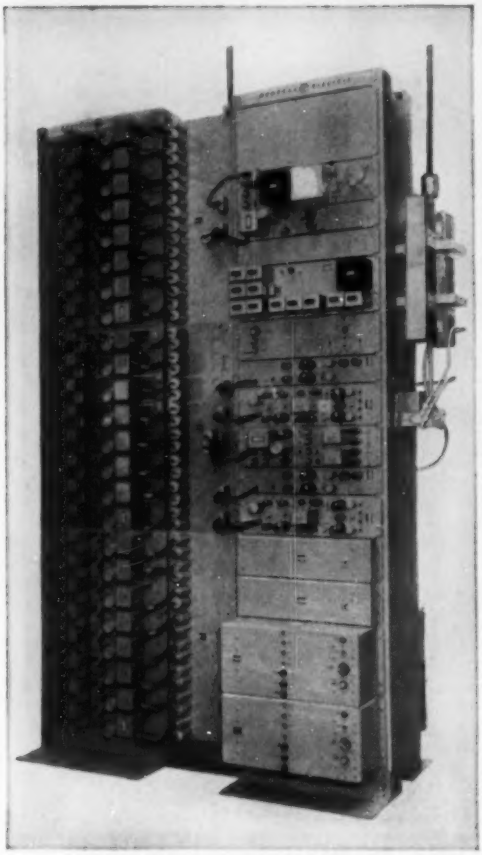
☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

Name .....
Firm .....
Address .....
City ..... State .....

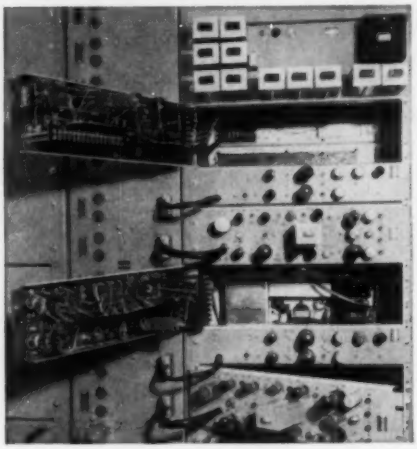
***U·S·S Tiger Brand*** **ELECTRICAL WIRE & CABLE**

**UNITED STATES STEEL**

# IMPROVE YOUR MICROWAVE RELIABILITY WITH NEW G-E QUADRIPHASE*



*The new General Electric Quadriphase system utilizes four 9 KC sine waves phased in quadrature for selection of the individual channels.



▲ New ease of servicing—units arranged to slide out or swing out for service or inspection without interrupting operation.

◀ G-E 25-channel, 2000 MC Quadriphase microwave terminal, showing all multiplex equipment. Normal and standby transmitters, receivers, power supplies and termination units are mounted on the other side of these racks.

## Highly stable channel-determining concept increases "On-The-Air" time

NEW General Electric Quadriphase is the only multiplexing system with channel selection determined by resistance circuits alone. There are no L-C networks . . . no tuned circuits . . . and no delay lines. As a result, you get more reliable microwave communication.

G-E engineers report numerous benefits from the new Quadriphase multiplex design—

**MAXIMUM STABILITY AND RELIABILITY**—far greater than is possible in multiplex systems requiring tuned circuits.

**FEWER CHANNEL ADJUSTMENTS**—only 2 necessary—one on the audio level in, and one out.

**FEWER TUBES** in multiplex, transmitter, and receiver. Total—less than 8 per voice channel!

**FAR LESS MAINTENANCE TIME AND EXPENSE**—You save on tube inventory and on maintenance time. Because every tube is used well below its maximum rating, G-E Quadriphase gives you a big safety margin, and extra tube life. Simplified circuitry including new printed circuits means quick checking and servicing.

**30% LESS FLOOR SPACE FOR RACKS**—Packaging is compact—only 4 racks instead of 6 required in previous 25-channel microwave equipment.

See for yourself how to get more reliable microwave communication at less operating and maintenance expense. For complete details about the new concept of G-E Quadriphase, write today. *General Electric Company, Microwave Equipment, Section X1955-16, Electronics Park, Syracuse, N.Y.*

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

Another Utility Case History

# Since 1939: thousands of poles preserved with low-cost PENTA

Since WISCONSIN POWER AND LIGHT COMPANY installed its first Penta-treated pole 16 years ago, the company has placed nearly 15,000 more Penta-treated western red cedar and southern yellow pine poles, and countless western fir crossarms, in southern Wisconsin. Today, even the oldest of these units are as good as new, have *many more years* of service ahead of them—an impressive example of lasting Penta wood protection!

**ELIMINATE REPLACEMENT OF CROSSARMS WITH PENTA**

Not only does it cost $5 or more to replace a single crossarm, but consider the trouble and expense of freighting timber, working "hot" lines, switching attachments to thousands of new crossarms a year! Penta eliminates crossarm replacement by protecting wood against rot and insect attack. Crossarms treated with Penta last the 30-year lifetime of a pole! And the cost of preserving wood with Penta is surprisingly low, in fact the cheapest insurance you can buy!

**SPECIFY PENTA PROTECTION** for Poles . . . Crossarms . . . Transformer Platforms . . . Braces . . . Control Boxes . . . Planking. Mail coupon below for list of more than 85 treating plants that will apply Penta for you, and for FREE Penta booklet, "Poles and Crossarms."

**PENTA-TREATED WOOD DOESN'T BURN HANDS**

Penta stays locked in wood, can't bleed or leach out! That's why Penta-treated wood is clean, can't "burn" hands or stain clothing.

**MONSANTO**
CHEMICALS – PLASTICS

SERVING INDUSTRY, WHICH SERVES MANKIND

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Box 478-V-4, St. Louis 1, Missouri

Please send: ☐ List of Penta-treating plants
☐ FREE "Poles & Crossarms" booklet

*Name*.....

*Address*.....

*City*..... *State*.....

# BRAND-NEW FIRE KILLER!

"WOW- trigger release for fast action!"
"HEY- pistol grip for easy handling!"
"SEE- new dust and moisture-proof gauge shows pressure at a glance!"
"BOY- powder won't pack, can't clog extinguisher!"
"LOOK- diffuser horn gives wider coverage in any position!"
"SAY- has reinforced bottom, won't topple over!"
Kidde
DRY CHEMICAL FIRE EXTINGUISHER

Leave it to Kidde to come up with a red-hot idea like this — a big, new 10-pound dry chemical extinguisher that's effective at *any* pressure from 150 to 250 pounds!

Naturally, this new Kidde 10-pounder has all the special features that make the Kidde Dry Chemical line second to none — fast action, easy handling, simple trigger operation, and extra-wide coverage that snuffs out fire in seconds. But the "wide operating range" feature is what makes the 10-pounder a real standout!

Unlike other extinguishers, which usually operate at one pressure only, the Kidde 10-pounder works through an extremely wide pressure range. Even when charged as low as 150 pounds, the Kidde 10-pounder is UL-approved for Class B and C fires. Boost the charge to 250 pounds, and you have a fire extinguisher with an *extra* hard-hitting punch!

For fighting fires in deep-burning liquids, electrical machinery and other hard-to-get-at places, *nothing* beats a Kidde Dry Chemical Extinguisher. See to it that *you* have Kidde protection. Call Kidde today!

**Kidde**

* The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

**Walter Kidde & Company, Inc.**
**530 Main Street, Belleville 9, N. J.**
**Walter Kidde & Company of Canada, Ltd., Montreal—Toronto**

# Utilities can depend on equipment containing C-D-F Insulating Parts

The reliable operation and long life of heavy electrical equipment often depends on insulating parts. A good supplier of insulation draws from past experience to make this possible—C-D-F has been a recognized industry leader since 1895! A good supplier expands his research and technical skill consistently—C-D-F offers the *widest range of electrical insulating materials*, from Vulcanized Fibre to C-D-F Products of Teflon.*

## A BIG, RELIABLE SOURCE OF SUPPLY

As a buyer of Utility Electrical Equipment, you gain when your manufacturers work with C-D-F. Quality and dependability of electrical insulation, at reasonable cost, are guaranteed. The latest technical advances and ideas can flow freely between you and C-D-F's engineers. This page shows only a few of the many products C-D-F makes and fabricates for the electrical industry. Consult Sweet's Design File for catalog information, or call your C-D-F sales engineer (sales offices in principal cities)—you'll find he's a good man to know!

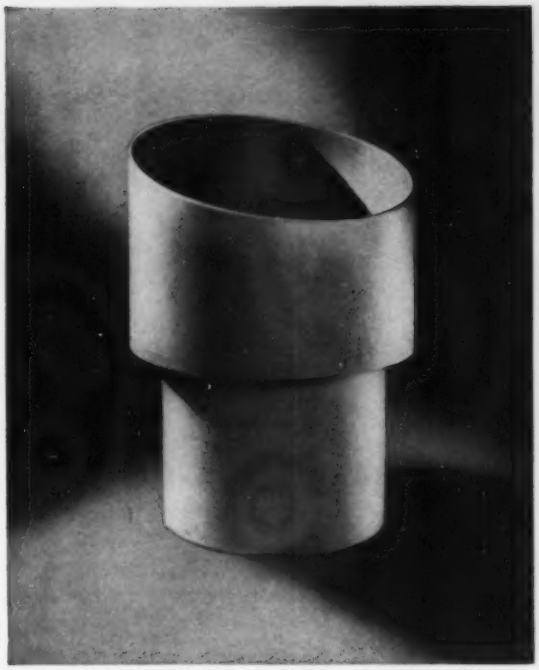
*Du Pont Trademark

C-D-F

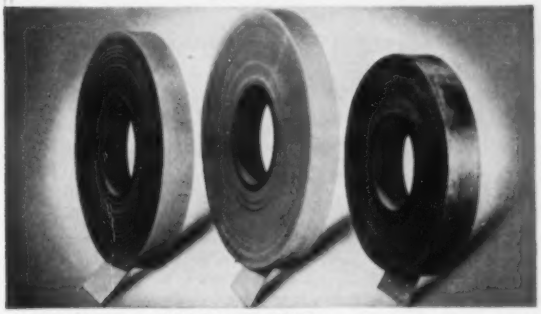
Continental-Diamond Fibre

CONTINENTAL-DIAMOND FIBRE COMPANY

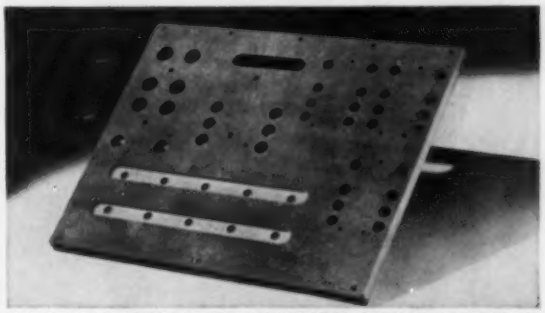
NEWARK DELAWARE



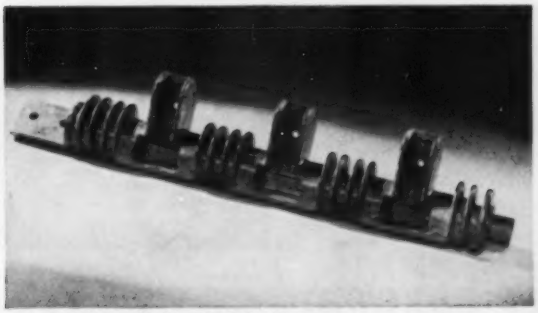
**C-D-F HANDLES THE COMPLETE JOB** An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!



**C-D-F MAKES FLEXIBLE INSULATION** To meet critical high heat and electrical insulating needs, C-D-F makes these efficient, easy-to-apply tapes. Size range is wide, with latest resins and backing materials used. Write for samples and technical bulletins of Silicone, Teflon, and Micabond tapes.

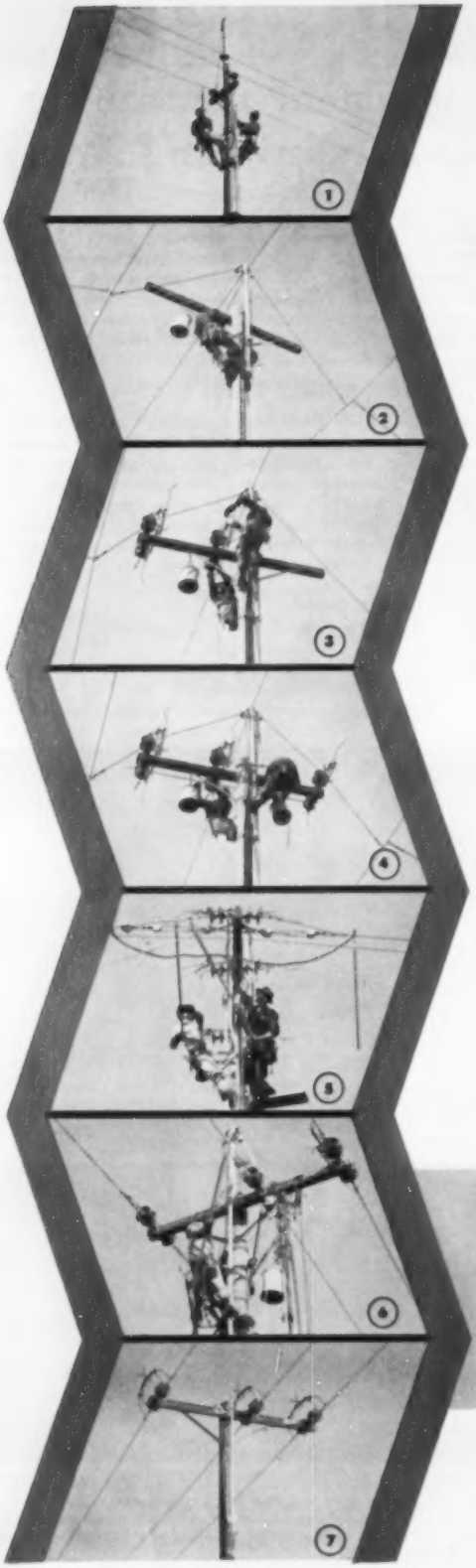


**C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS** Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space. New 1955 Dilecto catalog is yours for the asking, lists all new grades.



**C-D-F MOLDS MANY SPECIALTIES** This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing. Celoron has high impact strength, is used in switchgear.

**C-D-F GIVES YOU BETTER MOTOR AND GENERATOR INSULATION** All these built-up and bonded mica products are made by C-D-F to provide uniform high-heat resistance and dielectric strength. All forms of Micabond are made for better performance and lower costs.



# 22 KV HOT LINE SWITCH INSTALLATION

## in less than 6 hours

A unique feature of KPF Air Break Switches is the ease with which they can be installed on hot lines. An important reason for this convenience is the simple design of KPF switches. They consist of two rigid dead end insulator assemblies with rigid jumpers forming the switch arms. One assembly is mounted stationary to the cross-arms. The other rotates to make and break the circuit. There are no complex parts to get out of order, require lubrication, adjustment or service. KPF switches serve indefinitely, are shipped ready for use requiring only bolting to the cross-arm and connection of conductors.

Pictures alongside illustrate a 22 kv hot line installation typical of those made regularly by leading power companies using KPF switches.

**1.** Line crew on job at 8:30 A.M. Gin pole installed and linemen start to untie and spread hot 22 kv line 3/0 copper. **2.** Line wires spread and new cross-arms installed for KPF switch. **3.** Switch being installed. **4.** Switch installed and adjusted ready to cut-in. **5.** Bypass jumper and blocks installed. Lineman about to deadend 3/0 copper into automatic deadend attached to KPF switch. **6.** Lineman lowering last conductor into position to be cut into switch. **7.** Switch complete and ready for operation. Time 3:10 P.M.

*Get catalog, complete specifications, write direct*

**KPF**

**AIR BREAK SWITCHES**

*Standard for nearly half a century*

**KPF ELECTRIC COMPANY**

DEPT. E • 1624 E. ALPINE AVENUE • STOCKTON 5, CALIFORNIA

*New*

# A REVOLUTIONARY *NEW* HOT DIP GALVANIZING FOR TRIANGLE ARMORED CABLE AND FLEXIBLE CONDUIT

Triangle's Armored Cable and Flexible Steel Conduit are now **protected, inside and out,** with a special process hot dip galvanizing (exclusive with TRIANGLE) that blankets the steel and every crevice completely with an even "Silver" coat. It not only gives perfect protection against corrosion, but it is clean, bright, smooth and allows full flexibility of the Armored Cable and the Flexible Conduit.

***In addition:***

1. **Both are made from the finest steel and give *rugged* protection to the wires.**
2. **Both employ a unique method of interlocking each successive turn to guarantee against an accidental opening when being bent.**
3. **In both, the interior surfaces are *completely* free of burrs and sharp edges.**
4. **Triangle's Armored Cable is *double*-bushed. The fiber bushing and the folded back paper wrap accomplish this *double* protection at the ends.**

When you purchase Armored Cable or Flexible Conduit, why not ask for one that gives *complete* protection from every angle?—That's TRIANGLE! Whether the danger is from moisture, mechanical damage or human error, the word Triangle means *protection.*

*It Must Be Right*

The Trade Mark of TOP Quality

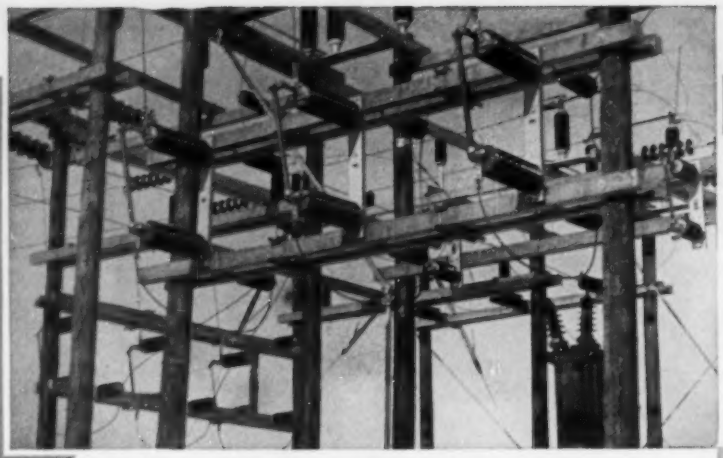
TRIANGLE

## TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, N. J.

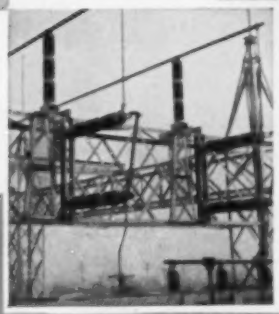
*Manufacturers of Arteries for Electricity, Liquids and Gases*

WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE



MAINE—The 69 kv B Series Power Fuses shown at the left are in service for Maine Public Service Company at Presque Isle.

TEXAS—Below are some 138 kv Type HMH-1 Power Fuses in service at a Texas utility's substation. The Type HMH-1 is available in interrupting ratings up to 30,000 amps.



# SOUTHERN STATES POWER FUSES SAVE UTILITIES UP TO $45 EACH TIME A FUSE BLOWS

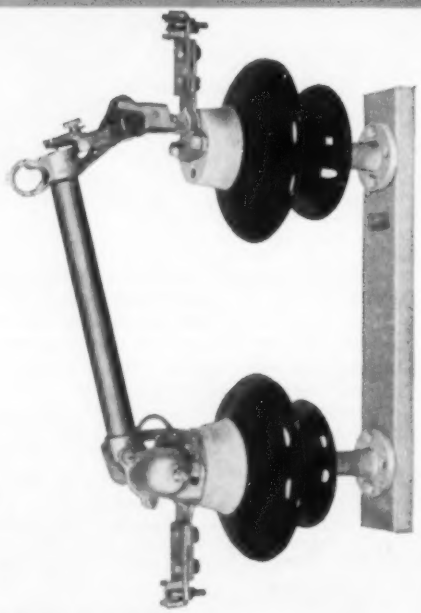
How much does it cost your company when a power fuse blows? Seventy cents to $3, or $5 to $50? By using inexpensive links instead of costly refills, Southern States power fuses may cut re-fusing costs as much as 800%.

There are additional savings, too. In a matter of minutes a lineman can re-fuse the unit, saving valuable time. No factory servicing is necessary. Expensive stocks of spares are eliminated. Less storage space is required. These all add up to savings too sizable to overlook. That is why utilities coast to coast are using Southern States Power Fuses.

These full dropout fuses are available to meet most requirements: Voltage ratings from 7.5-161 kv, continuous current ratings from 50-400 amps, and interrupting ratings up to 30,000 RMS amps. *Southern States Power Fuses have the highest interrupting capacity of any expulsion type fuse.*

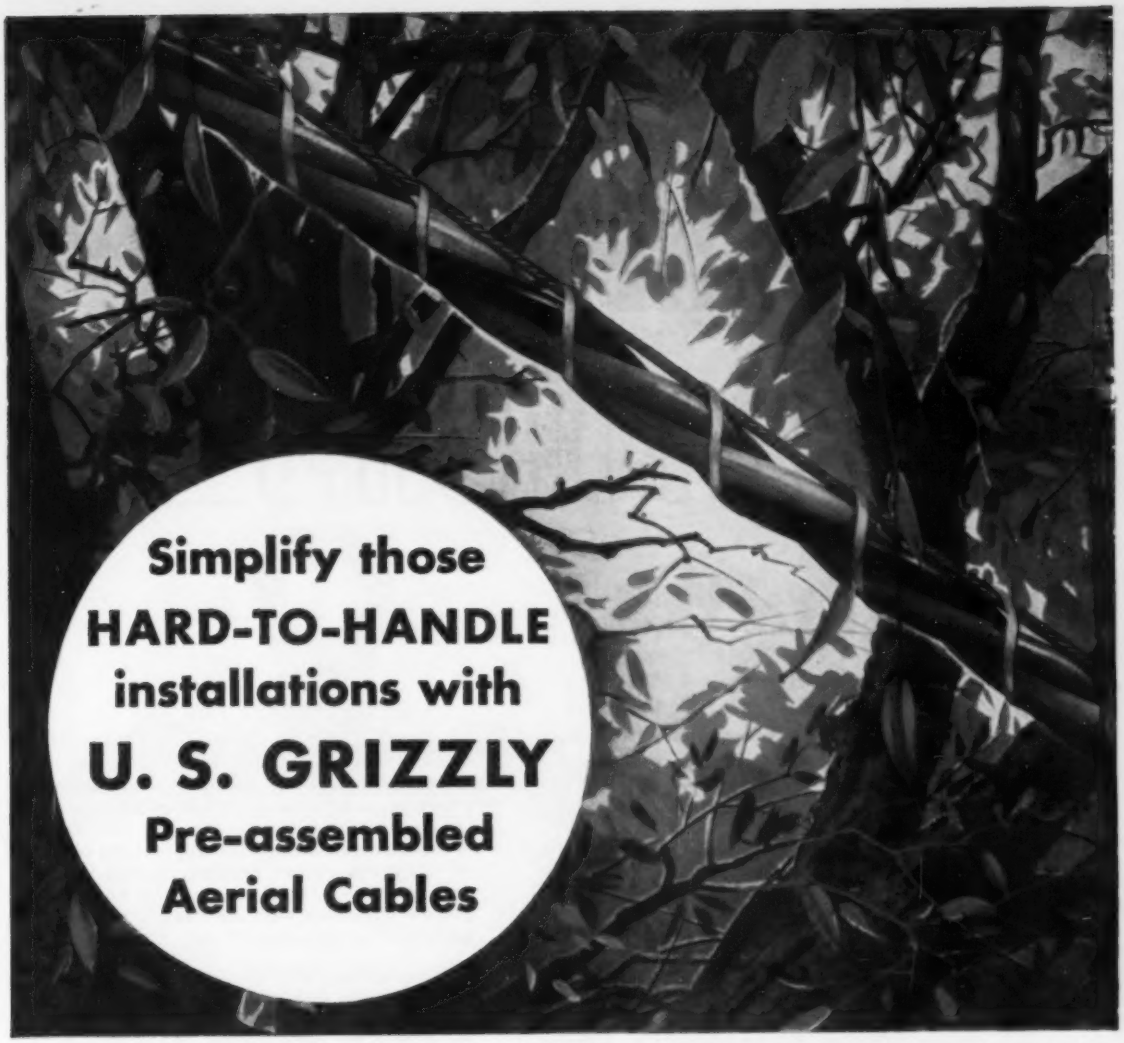
They are not simply oversize cutouts, but have high mechanical strength to assure perfect performance for years, even after repeated operation. Snubber action allows the fuse holder to swing down to a cushioned, shock-free stop. Double-venting reduces shock force on insulators. Interchangeability of tubes permits increases in continuous current and interrupting ratings without changing fuse mountings.

Count the savings, check the advantages, and see why it will pay to use Southern States Power Fuses on your system.



**SOUTHERN STATES EQUIPMENT CORP.**
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



# Simplify those HARD-TO-HANDLE installations with U. S. GRIZZLY Pre-assembled Aerial Cables

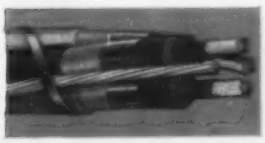
Check the following advantages of U.S. Grizzly® Pre-assembled aerial cables over ordinary open-wiring installations.

**1.** Less tree trimming is required, and therefore is less objectionable to the community. Can usually be installed in a more direct route.

**2.** Longer spans and fewer poles due to messenger's great strength.

**3.** Better appearance because of the elimination of cross-arms and less congestion at the poles.

**4.** Better service continuity because of high strength supporting messenger.



U. S. Grizzly pre-assembled aerial cable, 15,000 volts. Type RR —3 conductor, Uskor-ona® ozone-resistant insulation — shielded — Neoprene jacket.

**5.** Better voltage regulation because the conductors are bound closer together.

**6.** Lower installation and maintenance costs.

**7.** Permits shorter poles.

**8.** Made by United States Rubber Company, specialists in electrical insulation, the only electrical wire and cable producer to grow its own natural rubber, make its own synthetic rubber and manufacture its own plastics.

For more information, write to address below.

**FREE BOOKLET**

Write for your copy of free booklet giving full information about U. S. Electrical Wires and Cables for the Electric Utility Industry.

US RUBBER

## UNITED STATES RUBBER COMPANY

**Electrical Wire and Cable Department • Rockefeller Center, New York 20, N. Y.**

# Look at the

# DIFFERENCE

# DROP FORGING

# makes

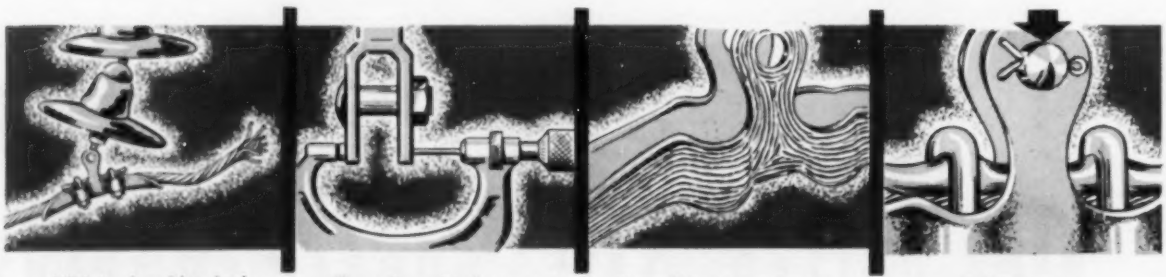
**Comparison shows why it pays to specify BTC Drop-Forged Hi-Line Hardware**

FORGING WAS FIRST USED by prehistoric man to shape metals to usefulness. Today, it's employed not only to shape metal but to impart strength, lightweight and uniformity of structure as well. The repeated blows of the forging hammer, press or upsetting machine refine the grain structure, toughen the metal.

Brewer-Titchener was first to introduce a standardized line of drop-forged high voltage transmission line hardware. Today, BTC offers a complete line of drop-forged parts and assemblies for your use.

Closed die forging gives BTC Hi-Line Hardware greater strength and soundness, in addition to finer finish and closer dimensional fidelity than can be obtained by other processes. Through forging, BTC Hardware acquires a uniform, fibrous, close-grained structure . . . with the grain flow advantageously following the contour of the part. This results in superior mechanical strength plus the ability to withstand severe loading, sudden shock and frequent reversal of stress as well as to prevent excessive wear on flexibly connected load-bearing surfaces.

Forging permits BTC to design parts and assemblies with lighter sections without sacrificing desired strength. BTC Forged Steel Hardware, for example, may be heat-treated to increase strength up to 50% without adding undesirable mass and weight. All BTC Forged Aluminum Alloy Conductor Clamp Parts are fully heat-treated. The more-than-adequate catalogued strength ratings of BTC Hardware are conservative and are exceeded in actual tests.

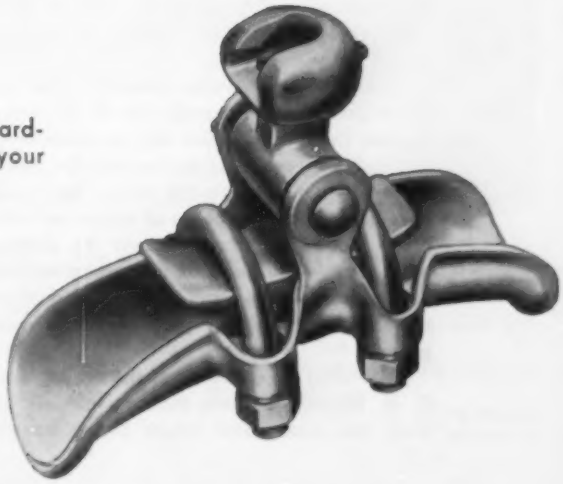


Withstands sudden shock | Closer dimensional accuracy | Strength in contour structure | Resists wear on load-bearing surfaces

**CAST CLAMP**
Metal has no fibrous structure. Lower yield and tensile strengths . . . heavier sections necessary in critical areas . . . undesirable extra weight.

**BTC FORGED CLAMP**
Fibrous grain structure of metal conforms with shape of clamp . . . making clamp stronger, tougher, while permitting lighter-weight design.

**NEW BTC CATALOG!**
Latest, revised edition of BTC Hi-Line Hardware Catalog now off the press! Write for your **free** copy.



BTC

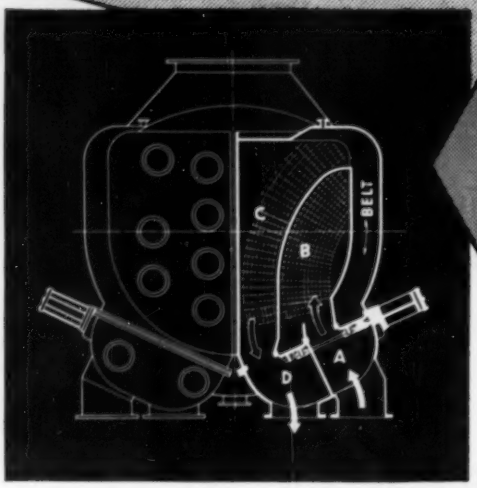
*Specify*

# DROP-FORGED Hi-Line Hardware

*. . From Your Insulator Manufacturer*

**THE BREWER-TITCHENER CORPORATION, Cortland, N. Y.**

# C. H. WHEELER "SELF CLEANING"
PATENTED
# REVERSE FLOW STEAM CONDENSER




REVERSE FLOW

Illustrated is the C. H. Wheeler tandem arrangement in which both sluice gates operate on a single stem. In this divided water box condenser, water enters chamber A with left hand port open and flows in through pass B, out through pass C and through left hand port D. To reverse the flow, gates move to left, closing the left hand ports and opening the right hand ports of chambers A & D. Water now flows through belt, in through C and out through B and right hand port of D. The same method applies, of course, to a non-divided water box design.

## No Shutdown — No Vacuum Loss for Tube Cleaning

The C. H. Wheeler Patented Reverse Flow design makes either single or divided water box steam condensers self-cleaning. These condensers are saving power plants countless hours of downtime and reduced load formerly required for manual removal of debris and organic growth from clogged tube sheets.

"Self-Cleaning" is accomplished by a set of sluice gates built integrally into C. H. Wheeler Surface Condensers which may be electrically or hydraulically operated to reverse the flow of cooling water through the tubes. This sudden flushing-in-reverse removes all debris and crustaceous matter and carries it out the discharge while carrying full load on the turbine and without reducing water flow. Also, the quick change in temperature shocks and dislodges marine growth.

Depending on condition of the cooling water, C. H. Wheeler Reverse Flow condensers have gone two years and longer before requiring cleaning. A typical field report tells of regaining a half-inch loss of vacuum (due to fouled tubes and tube sheets) five minutes after reversing the flow of condenser cooling water.

C. H. Wheeler custom - designs Reverse - Flow Condensers to suit any installation, arranging sluice gates and nozzles at top or bottom of water box and at any angle desired. Call a C. H. Wheeler representative to go over your specifications. It will mean years of substantial savings.

**(BULLETIN 410 mailed on request)**

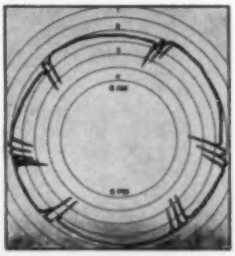


Chart shows typical cycle of vacuum and effect of reverse flow in a C. H. Wheeler Patented Self-Cleaning Reverse Flow Condenser. Note that because of 100% back flushing, the loss of vacuum during the reverse flow cycle is negligible.

**PARTIAL LIST OF INSTALLATIONS**
**OF C. H. WHEELER "SELF-CLEANING" REVERSE FLOW STEAM CONDENSERS**

General Electric Co., Lynn Plant . . 8,900 sq. ft.
General Electric Co., Lynn Plant . . 12,500 sq. ft.
Keystone Steel & Wire, Peoria . . 10,000 sq. ft.
Virginian Railways, W. Va. . . . . 15,000 sq. ft.
City of Wyandotte, Mich. . . . . 12,000 sq. ft.
City of Kansas City, Kansas. . . . 32,500 sq. ft.
New Bedford Gas & Edison Light,
New Bedford, Mass. . . . 16,500 sq. ft.
New Bedford Gas & Edison Light . 25,000 sq. ft.
Connecticut Light & Power Co.,
Montville Station . . . . . 24,000 sq. ft.

Connecticut Light & Power Co. . . 24,000 sq. ft.
Connecticut Light & Power Co.
Devon Station . . . . . 50,000 sq. ft.
Georgia Power Co., Atkinson Station, 47,000 sq. ft.
Alabama Power Co., Units 1 & 2
Gadsden Station . . . . . 47,000 sq. ft.
City of Holland, Michigan . . . . . 13,000 sq. ft.
South Carolina Electric & Gas,
Unit #1 Urquhart Station . 45,000 sq. ft.
South Carolina Electric & Gas,
Unit #2 Urquhart Station . 45,000 sq. ft.

Connecticut Light & Power,
Montville Station . . . . . 55,000 sq. ft.
Monongahela Power Company,
Albright #3 . . . . . 65,000 sq. ft.
Georgia Power Company,
Hammond Station, Units 1-2-3, 74,000 sq. ft.
City of Jacksonville, Fla.,
Southside Station . . . . . 40,000 sq. ft.
Tallyrand Station . . . . . 40,000 sq. ft.

# C. H. WHEELER *of Philadelphia*

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

Steam Condensers • Centrifugal, Axial and Mixed Flow Pumps • Steam Jet Ejectors • Vacuum Refrigeration
High Vacuum Process Equipment • Micro Particle Reduction Mills • Marine Condensers and Feeders • Dairy Machinery

# the features you want

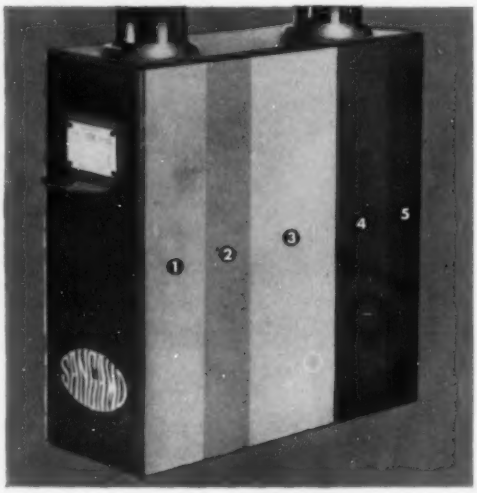
# NEW Sangamo

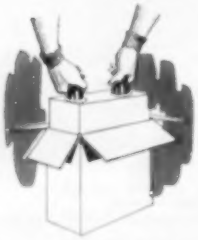
*The new Sangamo Power Capacitor combines features which result from efficient design, the use of materials developed by modern chemistry and metallurgy, and exact processing methods — all to assure performance stability.*

### COMPLETELY CORROSION-PROOFED CASE

Tin-plating of the steel case eliminates rusting during processing, and aluminum metallizing resists corrosive elements in service. Even if the external surface is scratched through to the bare steel the aluminum being anodic to the steel, provides electro-chemical protection. Here are the five steps required to give Sangamo's enduring case finish.

1. Case is tin-plated inside and out.
2. After impregnating and sealing, capacitor is sandblasted, preparatory to aluminizing.
3. Several coats of molten aluminum are sprayed on case.
4. Primer coat of vinyl-base resin paint is applied.
5. Final coat, also of vinyl-base resin paint assures a highly weather-resistant finish.



### SOLDER-SEALED BUSHINGS

Bushings are permanently and hermetically bonded to the cover, a bond which is mechanically strong, too. The capacitor can be handled by the bushings without the slightest danger of loosening the seals.

### TEMPERATURE STABILIZED IMPREGNANT

Sangamo's stabilized Diaclor will not congeal at the lower temperatures. Hence, Diaclor capacitors can be operated in switched or unswitched banks at temperatures as low as minus 40°C.

### TIN-COATED PARALLEL GROOVE CONNECTORS

Copper or aluminum conductors—from #8 solid to #4 stranded — can be used. Tin-plating retards corrosion. Connections can be made without removing terminal nut.

### STANDARD MOUNTING

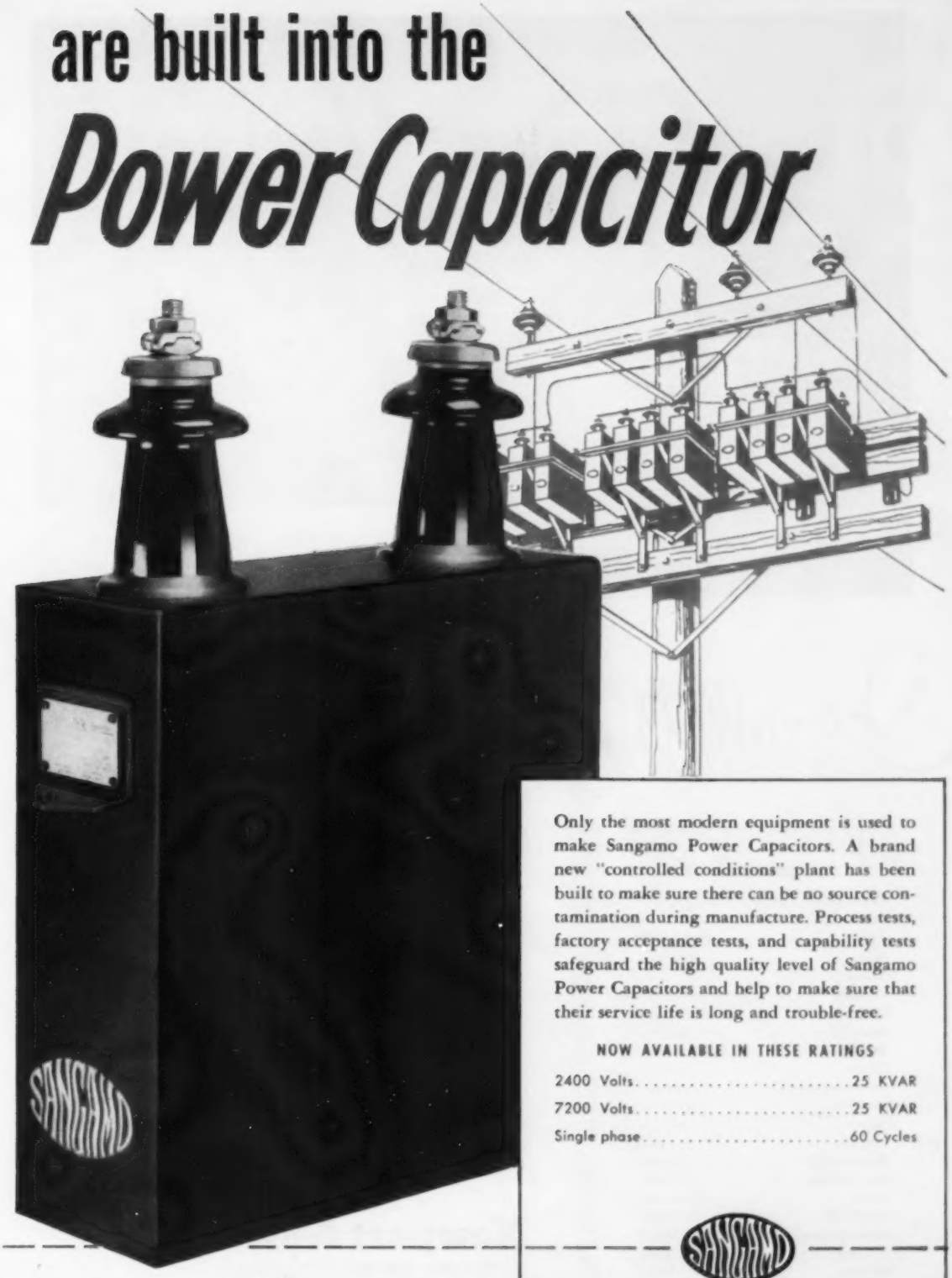
Mounting dimensions have been standardized to enable mounting in NEMA standard hangers. NEMA standard one-unit, two-unit and three or four-unit hangers are available from Sangamo.

If you would like to know more about Sangamo Power Capacitors, write today for your copy of Bulletin 1120 or contact the Sangamo representative in your area.

**SANGAMO ELECTRIC COMPANY**

SPRINGFIELD, ILLINOIS

# are built into the *Power Capacitor*



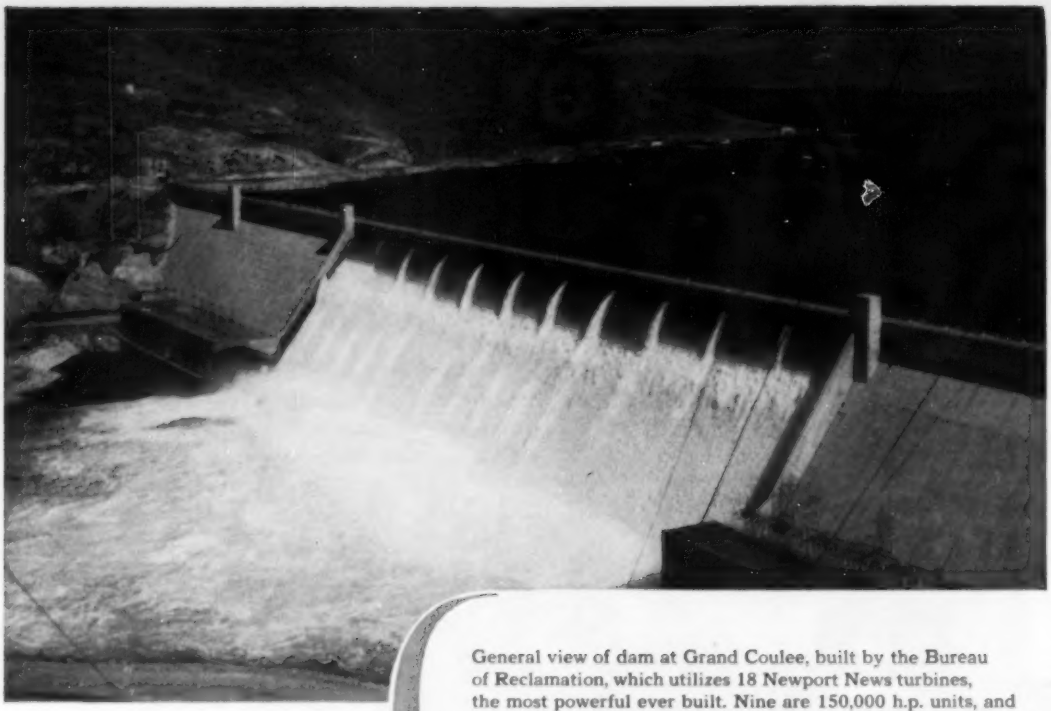

Only the most modern equipment is used to make Sangamo Power Capacitors. A brand new "controlled conditions" plant has been built to make sure there can be no source contamination during manufacture. Process tests, factory acceptance tests, and capability tests safeguard the high quality level of Sangamo Power Capacitors and help to make sure that their service life is long and trouble-free.

**NOW AVAILABLE IN THESE RATINGS**

| | |
|---|---|
| 2400 Volts | 25 KVAR |
| 7200 Volts | 25 KVAR |
| Single phase | 60 Cycles |

SANGAMO

PC55-2



General view of dam at Grand Coulee, built by the Bureau of Reclamation, which utilizes 18 Newport News turbines, the most powerful ever built. Nine are 150,000 h.p. units, and the other nine are rated at 165,000 h.p. each.

# Specialists ... in building Water Power Equipment

### Typical Users of Newport News Equipment

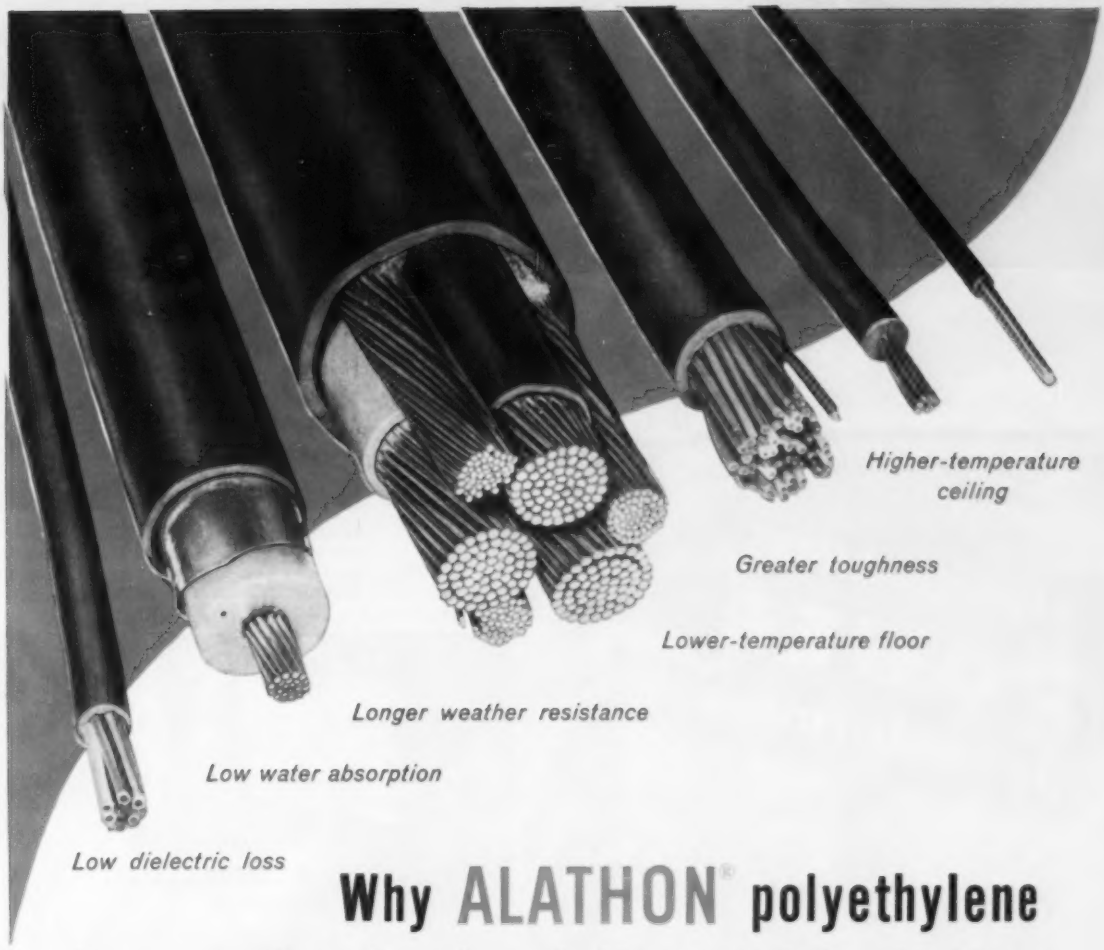
| PLANT | LOCATION |
|---|---|
| Boone | Tennessee |
| Buchanan | Texas |
| Caonillas | Puerto Rico |
| Chief Joseph | Washington |
| Clark Hill | South Carolina |
| Deer Lake | Newfoundland |
| Folsom | California |
| Fort Patrick Henry | Tennessee |
| Hiwassee | Tennessee |
| Hoover | Nevada |
| J. H. Kerr | Virginia |
| Jim Woodruff | Florida |
| Lower Salmon | Idaho |
| Norris | Tennessee |
| Rock Creek | California |
| Santee-Cooper | South Carolina |
| C. J. Strike | Idaho |
| Whitney | Texas |
| Wilson | Alabama |

Turbines designed and built for the world's largest development at Grand Coulee... and for other hydroelectric installations in America and various parts of the world... bespeak the skill and facilities offered by Newport News.

This trained organization has filled hydroelectric turbine contracts with an aggregate rated output of 7,000,000 horsepower.

Other equipment designed and built by Newport News includes penstocks, pressure regulators, valves, pumps, gates and rack rakes. Upon request, a copy of our illustrated booklet entitled "WATER POWER EQUIPMENT" will be sent to you.

**Newport News**
**SHIPBUILDING AND DRY DOCK COMPANY**
*Newport News, Virginia*




# Why ALATHON® polyethylene is superior for insulation and jacketing

New properties of "Alathon" polyethylene resin make it superior for insulating and jacketing of aluminum or copper conductors.

The higher melting point of Du Pont "Alathon" permits higher temperature ratings. The low brittleness temperature and improved abrasion resistance of "Alathon" assure years of trouble-free service. Jacketing of Du Pont "Alathon" is pliable, lightweight, and tough.

For more information, clip the coupon.

There *is* a difference in polyethylenes—

specify **ALATHON**
polyethylene resin

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 355 Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P. O. Box 660, Montreal, Quebec.

Please send me information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for

_____

Name _____ Position _____

Firm Name _____

Street Address _____

City _____ State _____

Type of Business _____

# Taming

**COATING RESISTANCE** is carefully measured with equipment shown above. Adjustments are made on coating machine with data from this test.

## ALLIS-CHALMERS POWER Transformers

**EPSTEIN TEST IS MADE ON** steel to recheck supplier report on watt loss per pound. Epstein strips are stress-relief annealed before undergoing tests. Multiple samples are taken from coils of steel, then tested in equipment shown above.

**VISUAL AND MICROMETER CHECKS** throughout all operations provide additional tests for size, lamination, and surface quality. At another point (not shown), core steel is annealed in special equipment in which atmosphere is controlled with respect to dew point to produce desired surface conditions.

# ALLIS-

# Temperamental Steel

## Suppliers Check and Allis-Chalmers Double Checks to Assure High Quality Core Steel . . . Top Performance for Transformers

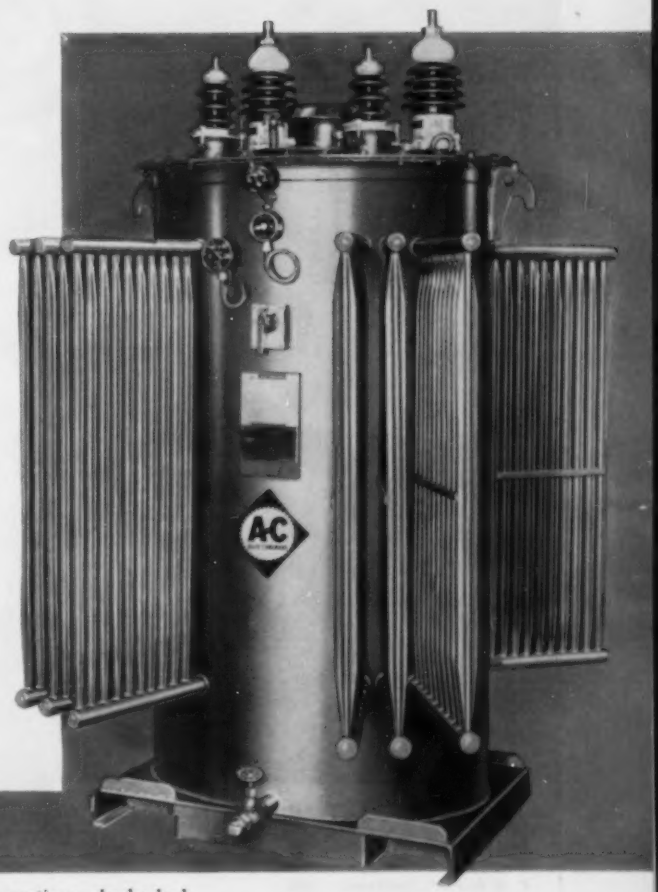
Suppliers apply tests to prove that core steel meets rigid specifications. But that's not enough for Allis-Chalmers. Here's what A-C engineers do to assure highest quality incoming raw materials.

**First step** extends right back into supplier plants. Allis-Chalmers engineers personally inspect supplier equipment and processes at regular intervals.

**As soon as steel** reaches an Allis-Chalmers transformer plant, re-checks of quality begin. They do not end until the completed transformer successfully passes all tests on the final assembly floor.

**Proof of the effectiveness** of these tests comes from the satisfaction of the hundreds of users of Allis-Chalmers transformers. If you would like further information on any of these rigid Allis-Chalmers tests for quality, your nearby A-C district office will get you more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, to arrange for a visit to Pittsburgh or Milwaukee so you can see for yourself why Allis-Chalmers offers the highest quality.

A-4704



**STEEL SAMPLES** are continuously checked to eliminate edge burrs that might result from cutting and slitting operations. Thus burrs cannot cut insulation coating on adjacent laminations which could permit eddy currents to build up, with resulting hot spots in core. Interlamination resistance tests after assembly provide further check.

# CHALMERS

A-C ALLIS-CHALMERS

# Helpful technical information- about Apparatus Bushings

If your job involves apparatus bushings—
LOCKE
APPARATUS BUSHINGS
Bulletin No. 1
Guide to Periodic Inspection and Repair of Apparatus Bushings
—you'll want this new 6-page booklet!

**PLEASE FILL IN AND MAIL**

**Locke Department**
**General Electric Company**
**P. O. Box 57, Baltimore 3, Md.**

Please send me information as checked below.

☐ Bushing Booklet ☐ Cantilever Strength Estimators
☐ Switch & Bus Insulator Selector

**Name:** _____

**Company:** _____

**Title:** _____

**Street Address:** _____

**City:** _____

This is the first of a new series of valuable technical booklets devoted to apparatus bushing maintenance. They will make your job easier by providing you with up-to-date, authoritative information on the subject of apparatus bushings. In developing these booklets, Locke has drawn upon its vast storehouse of bushing know-how. You'll find them of real value in your everyday work. For your copy, please fill in and mail coupon.

# ---from Locke--
# and Switch & Bus Insulators

If your job involves switch and bus insulators—
LOCKE
ENGINEERING
Data
No. 14
Cantilever Strength Estimators
Locke Switch and Bus Insulator Selector
—you'll want these Cantilever Strength Estimators and this new Switch & Bus Insulator Selector!

**THE CANTILEVER STRENGTH ESTIMATORS** make it easy for you to determine the cantilever load applicable to upright or underhung cap and pin type Switch & Bus insulators, at various distances beyond the free end of their mounting.

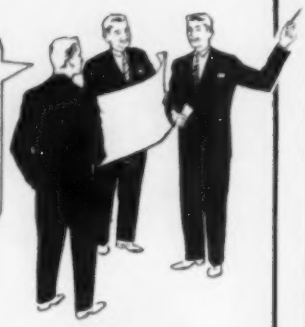
**THE SWITCH & BUS INSULATOR SELECTOR** is a specially designed, easy-to-use circular slide chart. With it, you can quickly determine the mechanical and electrical characteristics of an insulator stack for any given operating voltage or BIL.

For copies, please mail coupon at left.

**LOCKE**

**LOCKE DEPARTMENT**
**GENERAL ELECTRIC COMPANY**
**BALTIMORE, MARYLAND**

# Get this FREE Home Wiring Wall Chart!




You'll want to look over this handy and practical chart and consider its possibilities for use by electrical contractors, builders and architects in your area. Large quantities are available to you at special at-cost prices.

**AUTHORITATIVE!**

The wiring facts shown by this chart were worked out in collaboration with leading electrical contractors and modern adequate wiring experts. You can be sure of the facts it contains.

Typical loads and circuits for kitchen, laundry, living areas and fixed utilities are shown. Also typical power center and circuit requirements for a six-room house.

## LOAD AND CIRCUIT

### KITCHEN

| | Typical Wattage | Preferred Circuit | Volts | Wires | Breaker or Fuse | Number Outlets |
|---|---|---|---|---|---|---|
| RANGE | 12000 | 10 KW. | 120/240 | 3 #6 | 50A. 60A. | 1 |
| OVEN (Built in) | 4500 | 6 KW. | 120/240 | 3 #10 | 30A. | 1 |
| RANGE TOP (Heavy Duty) | 6000 | 6 KW. | 120/240 | 3 #10 | 30A. | 1 |
| RANGE TOP | 3300 | 4 KW. | 120/240 | 3 #12 | 20A. | 1 or more |
| DISHWASHER | 1200 | 2 KW. | 120 | 2 #12 | 20A. | 1 |
| WASTE DISPOSER | 300 | 2 KW. | 120 | 2 #12 | 20A. | 1 |
| BROILER | 1500 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more |
| FRYER | 1300 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more |
| COFFEEMAKER | 1000 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more |
| REFRIGERATOR | 300 | 2 KW. | 120 | 2 #12 | 20A. | 2 |
| FREEZER | 350 | 2 KW. | 120 | 2 #12 | 20A. | 2 |

### LAUNDRY

| | Typical Wattage | Preferred Circuit | Volts | Wires | Breaker or Fuse | Number Outlets |
|---|---|---|---|---|---|---|
| WASHING MACHINE | 1200 | 2 KW. | 120 | 2 #12 | 20A. | 1 |
| DRYER | 5000 | 6 KW. | 120/240 | 3 #10 | 30A. | 1 |
| IRONER | 1650 | 2 KW. | 120 | 2 #12 | 20A. | 1 |
| HAND IRON | 1000 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more |
| WATER HEATER | 3000 | | | | | |

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**Kennecott Copper Corporation**

*Fabricating Subsidiaries: CHASE BRASS AND COPPER CO. • KENNECOTT WIRE AND CABLE CO.*

# CHART FOR HOME WIRING SYSTEMS

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| Typical Outlets | Notes |
|---|---|
| | Use of more than one outlet is permitted, but not recommended. |
| | Appliance may be direct connected. |
| | Appliance may be direct connected. |
| | |
| | These appliances may be direct connected on a single circuit. Grounded receptacles required, otherwise. |
| | Heavy duty appliances regularly used at one location should have a separate circuit. Only one such unit should be attached to a single circuit at a time. |
| | Separate circuit serving only refrigerator and freezer is recommended. |

| | Notes |
|---|---|
| | Grounding type receptacle required. |
| | May be direct connected—must be grounded. |
| | Grounding type receptacle required. |
| | Consider possible use in other locations. |
| | Consult Utility Co. for load requirements. |

## LIVING AREAS

| | Typical Wattage | Preferred Circuit | Volts | Wires | Breaker or Fuse | Number Outlets | Typical Outlets | Notes |
|---|---|---|---|---|---|---|---|---|
| WORKSHOP | 1500 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more | | Separate circuit recommended. |
| PORTABLE HEATER | 1300 | 2 KW. | 120 | 2 #12 | 20A. | 1 | | Should not be connected to circuit serving other heavy duty loads. |
| TELEVISION | 300 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more | | Should not be connected to circuit serving appliances. |
| PORTABLE LIGHTING | 1200 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more | | Provide one circuit for each 500 sq. ft. Divided receptacle may be switch controlled. |

## FIXED UTILITIES

| | Typical Wattage | Preferred Circuit | Volts | Wires | Breaker or Fuse | Number Outlets | Typical Outlets | Notes |
|---|---|---|---|---|---|---|---|---|
| FIXED LIGHTING | 1200 | 2 KW. | 120 | 2 #12 | 20A. | 2 or more | | Provide at least one circuit for each 1200 watts of fixed lighting. |
| AIR CONDITIONER ¾ H.P. | 1200 | 2 KW. | 120 | 2 #12 | 20A. | 1 or more | | Consider 4 kw 3-wire circuits to all window or console type air conditioners. Outlets may then be adapted to individual 120 or 240 volt machines. |
| AIR CONDITIONER 1½ H.P. | 2400 | 4 KW. | 120/240 | 3 #12 | 20A. | 1 or more | | |
| CENTRAL AIR CONDITIONER | 5000 | 6KW. | 120/240 | | | | | Consult manufacturer for recommended connections. |
| SUMP PUMP | 300 | 2 KW. | 120 | 2 #12 | 20A. | 1 or more | | May be direct connected. |
| HEATING PLANT | 600 | 2 KW. | 120 | 2 #12 | 20A. | 1 | | Direct connected. Some local codes require separate circuit. |
| BATHROOM HEATER | 1500 | 2 KW. | 120 | 2 #12 | 20A. | 1 | | Direct connected. |

### TYPICAL POWER CENTER AND CIRCUIT REQUIREMENTS

6 ROOM HOUSE 1500 sq. ft.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30-kw Service | main | 100 amp 3w | 240/120 volts | Dish Washer | 1-2 kw | 20 amp 2w | 120 volts |
| 10-kw Range | 1-10 kw | 50 amp 3w | 240/120 volts | Oil Burner | 1-2 kw | 20 amp 2w | 120 volts |
| 3-kw Water Htr. | 1-4 kw | 30 amp 2w | 240/120 volts | Freezer-Ref. | 1-2 kw | 20 amp 2w | 120 volts |
| 5-kw Dryer | 1-6 kw | 30 amp 3w | 240/120 volts | Heater | 1-2 kw | 20 amp 2w | 120 volts |
| 1½-hp Cooler | 1-4 kw | 20 amp 2w | 240 volts | T.V. | 1-2 kw | 20 amp 2w | 120 volts |
| Clothes Washer | 1-2 kw | 20 amp 2w | 120 volts | General Purpose | 4-2 kw | 20 amp 2w | 120 volts |
| Ironer | 1-2 kw | 20 amp 2w | 120 volts | Portable App. | 3-2 kw | 20 amp 2w | 120 volts |

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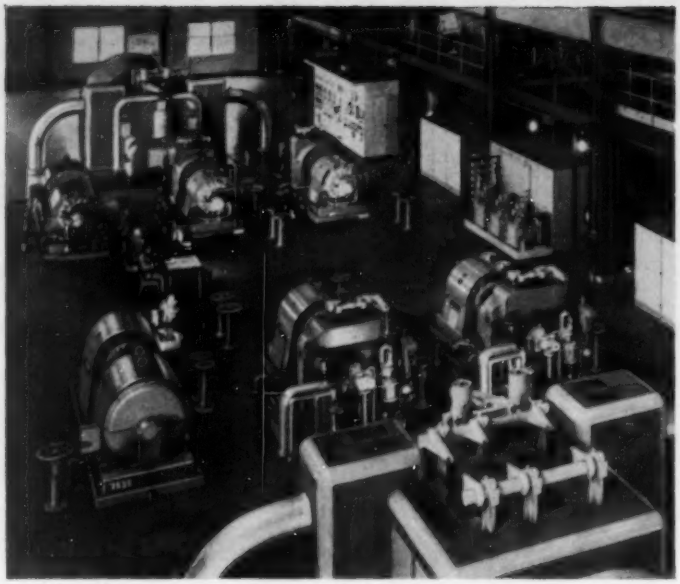
# What makes a barrel-type boiler feed pump *stay in service?*



## Here are some of the design features that assure dependability

Today's modern multi-stage centrifugal pumps for boiler feed service are the result of years of research and design. To provide efficient service *plus* dependability, De Laval has incorporated these important features in its barrel-type pump.

### Double Volute Diaphragms

Double volute diaphragms provide for radial hydraulic balance and assure a continuous rising head characteristic from the design point to shut-off. *RESULT—Higher efficiencies are maintained over a wider range of operation than are generally obtained with other forms of velocity pressure conversion.*

### Individual Diaphragm Bolting

Elimination of rabbet fits and gaskets permits straight metal-to-metal contact of adjacent lapped faces of the diaphragms which are individually bolted together to maintain tight joints and ease of assembly. *RESULT—Positive assurance against inner case leakage, complete elimination of misalignment causes and a minimum of distortion from sudden temperature changes.*

### Positive Sealing Between Suction and Discharge Chamber

Inner assembly is held at the inner high pressure joint at the suction end of the barrel, against a flexitallic gasket, with through bolts. The joint between the suction and discharge chambers is made tight during assembly—remains tight whether pump is operating or idle. *RESULT—No possibility of leakage or gasket loosening due to changes of force on the inner joint.*

### Bare Shaft

Bare shaft construction with split ring-shrink fit method of impeller mounting permits a scalloped shaft design and eliminates the need for spacer sleeves between impellers. *RESULT—Better hydraulic conditions at the eye of the impeller and elimination of spacer sleeves—the greatest cause of shaft warpage.*

### Wearing Rings

Diaphragms and impellers have renewable wearing rings. Impeller rings are threaded on the impeller hubs against rotation, and diaphragm rings are held by a breech lock fit in the diaphragms. *RESULT—Construction permits renewal of original clearances without major part renewal or modification. Labyrinth type diaphragm ring results in minimum leakage over a longer period of time than with close clearance flat rings.*

### IMO Oil Pump

A De Laval IMO pump designed for high speed operation is direct-connected to the outboard end of the barrel pump shaft, and is sized to lubricate both pump and driver bearings. *RESULT—Quiet, pulsation-free, positive displacement IMO pumps, assures positive lubrication and eliminates the need of extra shaft length and mechanical complications required by gear drive lube oil pumps.*

### BULLETIN CONTAINS HELPFUL DATA

This De Laval bulletin on the barrel-type boiler feed pump covers all major design points . . . has cross-section cut-away illustration for easy reference. Write on your business letterhead for your copy of Bulletin 1506 to De Laval Steam Turbine Company, 861 Nottingham Way, Trenton 2, New Jersey.

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## The World's Largest

# Hydraulically Operated Circuit Breaker

THIS Allis-Chalmers circuit breaker is now installed on a Western power system. It is rated 230 kv, 10,000,000-kva interrupting capacity.

The *Pneu-Draulic* operator used on this breaker is of the same basic design as those used on operators for Allis-Chalmers breakers from 13.8 kv up, and 500,000-kva to 10,000,000-kva interrupting.

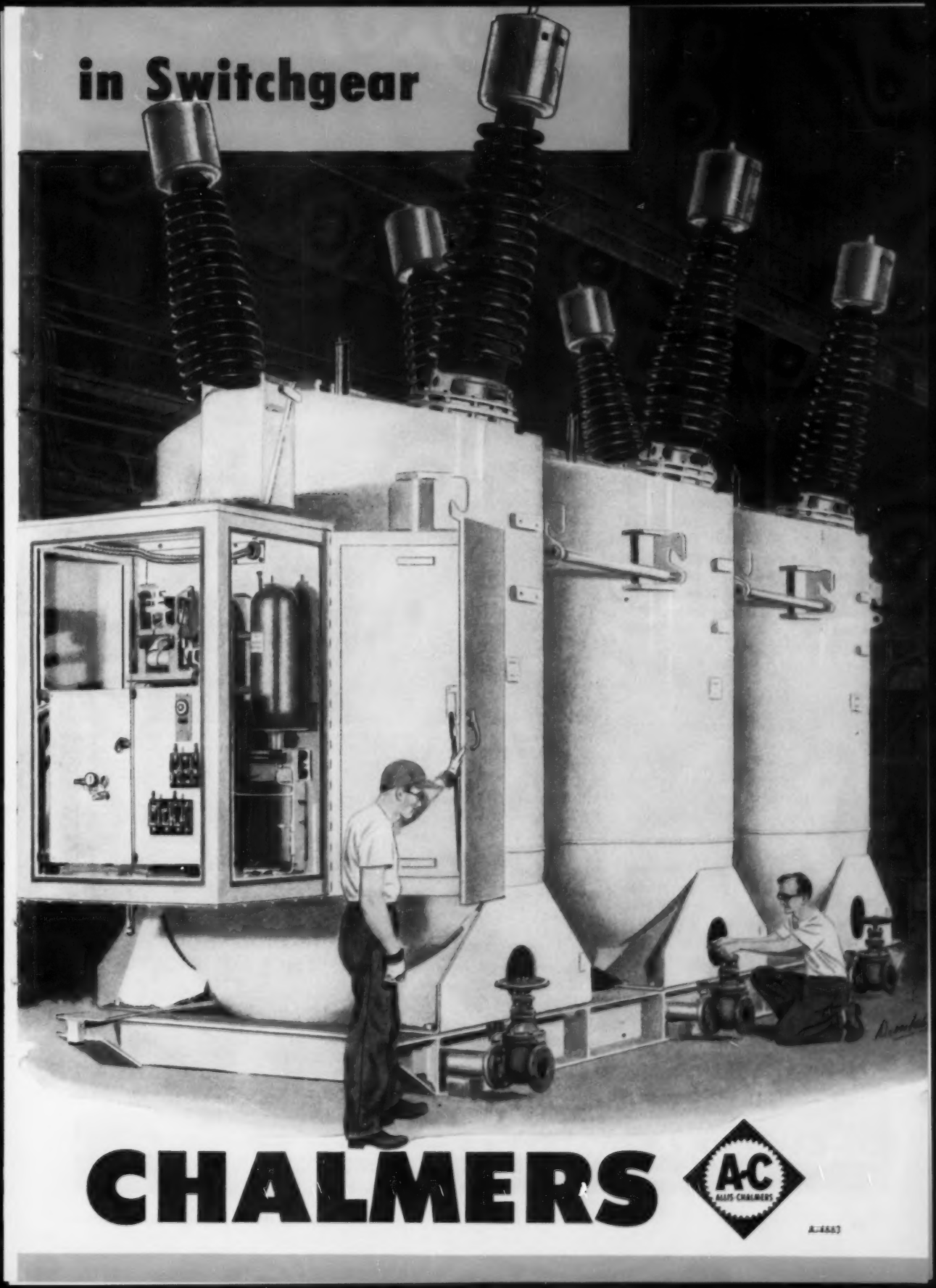
With the *Pneu-Draulic* operator even this enormous circuit breaker can be closed at full-rated speed under emergency conditions without use of control power. One man using one hand can easily pump up sufficient pressure in less than a minute for full-speed closing.

And it is perfectly safe to do this only because the operating mechanism is *mechanically trip-free*. Allis-Chalmers alone builds *all* breakers mechanically trip-free.

**GET COMPLETE INFORMATION:** Call your nearby A-C office or write Allis-Chalmers, General Machinery Division, Milwaukee 1, Wisconsin.

*Pneu-Draulic* is an Allis-Chalmers trademark.

**ALLIS-**


in Switchgear
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# Sturdy Towers Carry VEPCO Line Across the James

**Designers solve tricky problems in crossing 4.5-mile river with 110-kv transmission line**

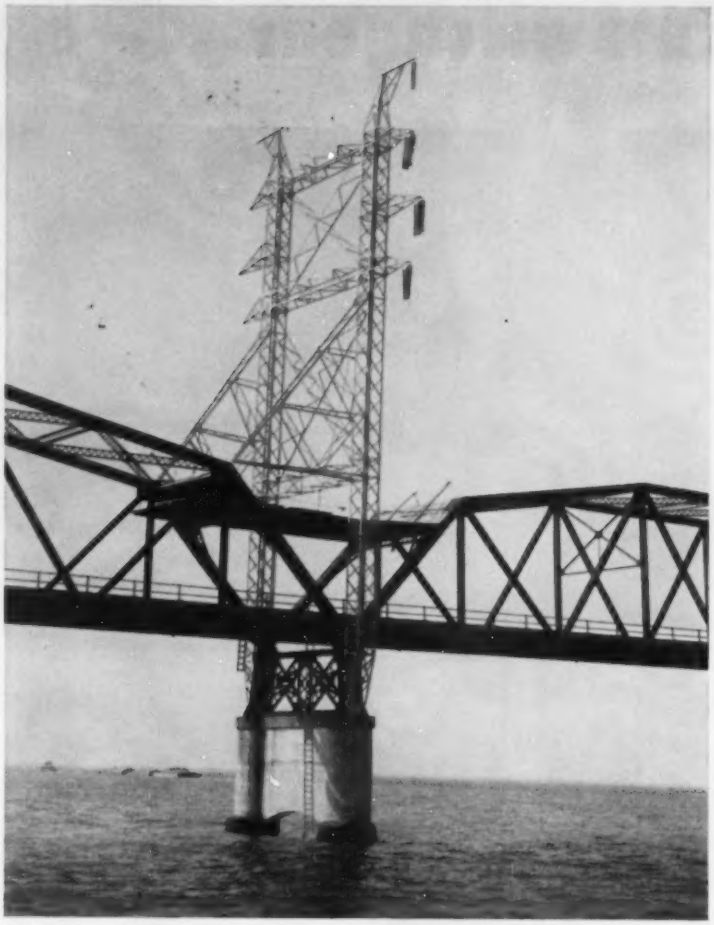
One of the most interesting transmission projects completed in 1954 was Virginia Electric & Power Co.'s James River crossing between Suffolk and Newport News. This line was built primarily to help supply the heavy power requirements of Langley Field.

A number of problems were faced in designing the 13,000-ft deep-water section of the line. Stone & Webster Engineering Corp., who developed and designed the project under the supervision of VEPCO, had to observe the War Department's minimum cable clearance requirement of 172.25 ft when crossing the 300-ft main channel, 100 ft where depth at MHW exceeds 10 ft, and 65 ft elsewhere. In addition, they had to protect the towers from impact by ship traffic.

**CHANNEL CROSSING** . . . Crossing of the 300-ft main channel was accomplished economically by attaching four sturdy steel tower frames, supplied by Bethlehem, to the bridge structure. Two of these frames were installed on the bridge trusses, as shown in the photograph, and two on the bridge's lofty lift-span towers.

The designers used three-sided towers fabricated by Bethlehem to span the remaining 11,500 ft of the deep-water section. These towers are mounted on concrete-capped, steel H-pile foundations protected from impact by the ingenious combination of inter-connected steel piles and concrete drag blocks shown in the accompanying diagram. The towers rise 222½ ft above their foundations.

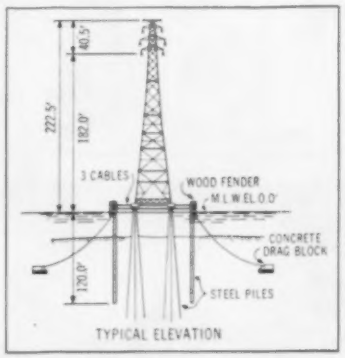
**LINE DESIGN** . . . At the outset the crossing was strung with one circuit of 477,000-cm ACSR conductors and two Copperweld ground wires. The conductors were strung on the basis of a maximum cable tension of 7,000 lb at medium loading of ¼-in. radial ice plus 8-lb wind. All but the north- and south-end steel towers were designed to have a safety factor of 1½, assuming two cables broken.



**The line is carried over the main navigation channel by towers connected to the superstructure of the James River Highway Bridge (U. S. 17). One of the towers is shown here prior to stringing.**

**FABRICATED IN LEETSDALE, PA.** . . . Steel for the 25 towers used in the crossing and approaches, totaling 480 tons, was fabricated and galvanized at the Bethlehem Fabricating Works in Leetsdale, near Pittsburgh. Other Bethlehem tower-fabricating shops are strategically located in South San Francisco, Calif., and Seattle, Wash.

If you would like to have further information about Bethlehem's design and fabrication of transmission towers, we suggest that you call on the nearest Bethlehem sales office.




**This drawing shows the novel method of protecting the deep-water towers from collision damage. Tripod tower construction avoids the secondary stresses that might result in 4-sided towers should settlement occur under one leg.**

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Bethlehem Pacific Coast Steel Corporation, San Francisco
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# Reliable Power for fast growing FLORIDA!

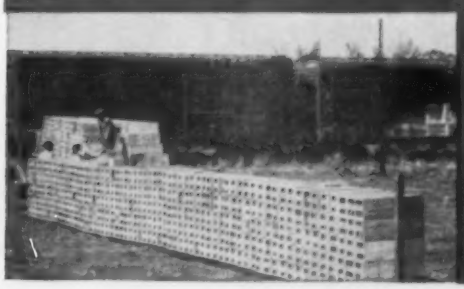
**FLORIDA POWER & LIGHT CO.** installing Porcelain Products suspension insulators on transmission lines as part of their $332,000,000 construction program.

One of the most steadily-growing states in all 48—that's Florida, with retail sales alone up 44% in the past five years. Yes, everything is growing bigger and faster in fabulous Florida—population, industry, and agriculture!

And pacing the progress of the Sunshine State is Florida Power and Light Company. Currently engaged in a $332,000,000 ten-year construction program FP&L has more than tripled its system capability since 1945.

Electricity, essential to expanding population and industry, must be conveyed across many miles of Florida terrain. In order to support and insulate this vast network of wires, FP&L buys thousands of Porcelain Products Transmission Insulators.

These ten-inch suspension insulators, noted for their high quality, mechanical-electrical strength, resistance to thermal variations and corrosive salt air, cut maintenance and replacement costs to a minimum—assure dependable electric service for FP&L customers.



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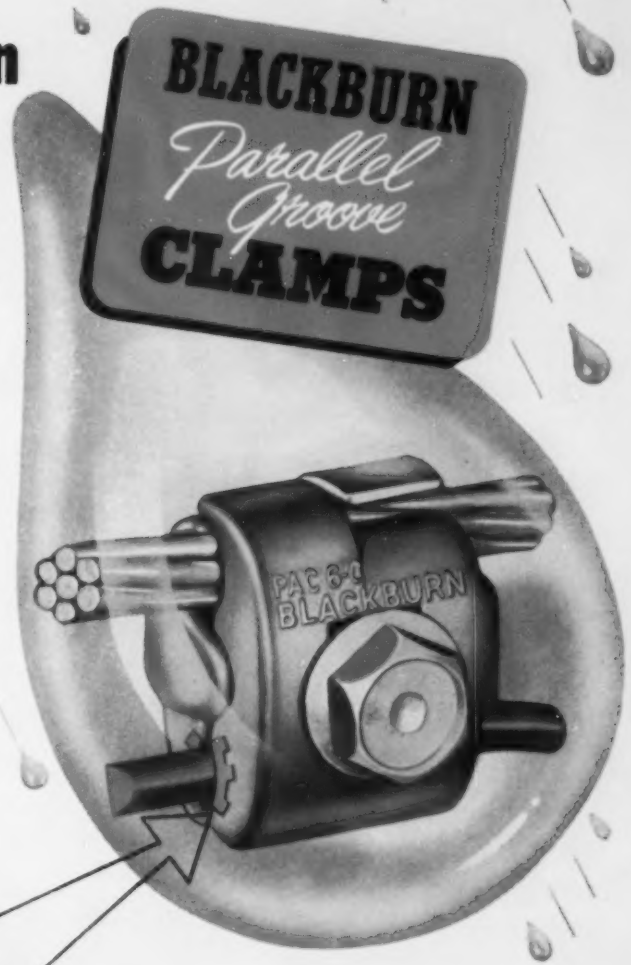


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Special surface treatment of under side of copper liner reduces surface tension of the molten aluminum—establishing a low-resistance contact between the two metals.

**CORROSION RESISTANT**

Aluminum bodies are cast of a highly corrosion-resistant alloy. The steel bolt, nut and lockwasher are hot dipped galvanized. Also available with aluminum hardware.

**ONE PIECE CONSTRUCTION**

No loose parts to assemble during installation—clamp bodies cannot be mated incorrectly—copper inserts always face each other.

Hexagon head steel bolt with square shank gives linemen option of using wrench on bolt head for tightening.

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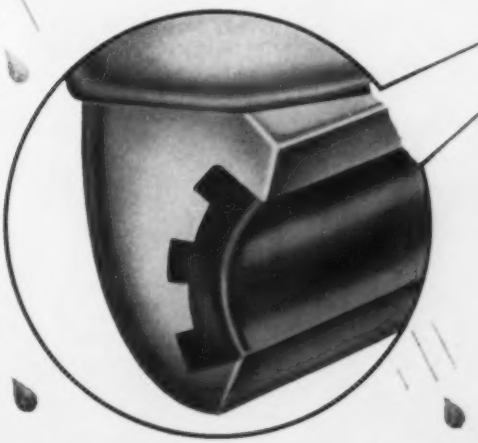

The molten aluminum has a coefficient of expansion 38% greater than that of the copper. As it shrinks in solidifying, great clamping force is exerted against the copper establishing an air-proof, moisture-proof joint. Because operating temperatures never approach the heat of molten aluminum, this key-lock shrink-fit is permanently maintained.

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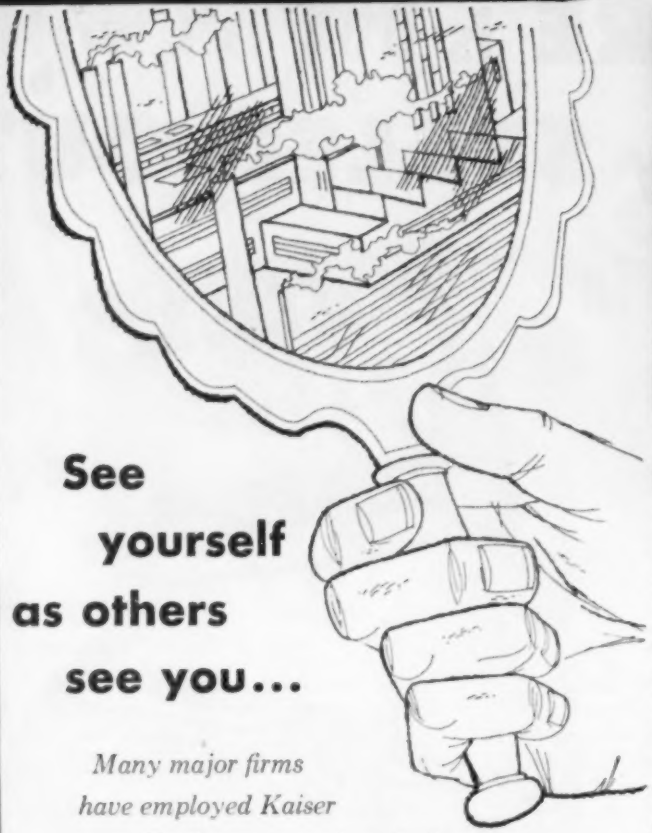

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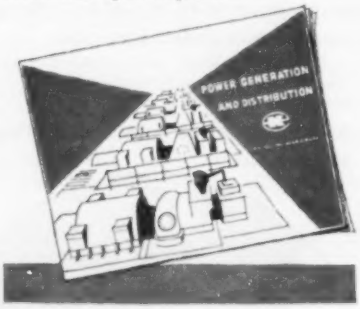


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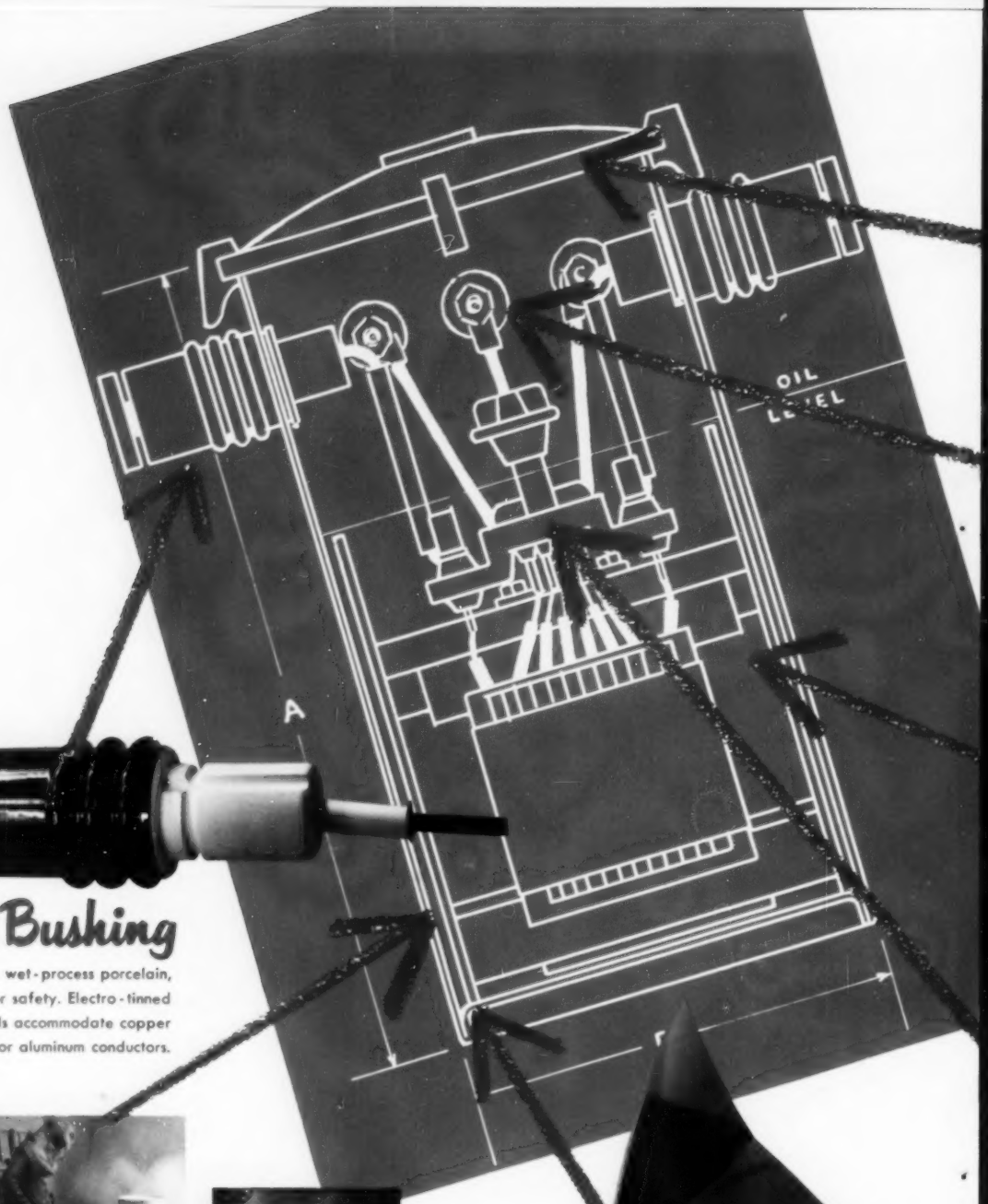

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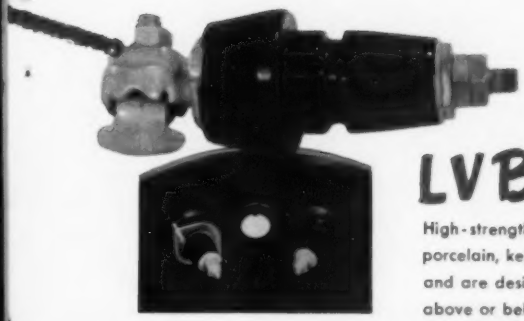

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High-strength, wet-process porcelain, keyed for safety and are designed for either above or below vertical takeoff.

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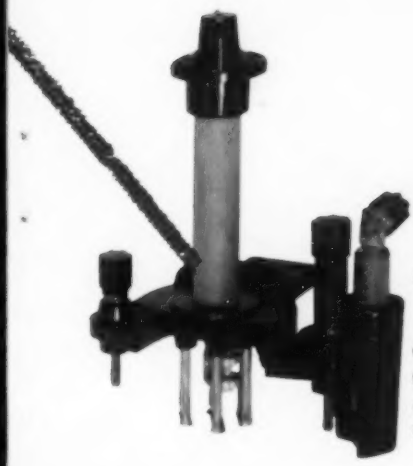
High permeability, cold rolled silicon steel cores are precision wound. Core and coil assemblies are tested along the production line to insure dependable operation in the field.



## Tap Changer

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# EDITORIALS

## When Is a Bargain a Bargain?

Price is an important consideration in any purchase contract. If it were the only element, all purchase contracts could be written on half a sheet of paper. The purchasing policies of electric utilities and other large buyers would be greatly simplified. Of more importance is the matter of quality, and that complicates the procedure.

Also because of the broad public responsibilities a utility must shoulder and because of the power wielded through its purchasing, there are many more considerations involved. To fulfill its broad responsibilities and to use its purchasing power wisely, the company's purchasing policies must be aimed toward:

- Promoting the long-range interests of utilities by maintenance of healthy competition among its suppliers.
- Providing some incentive for the establishment of new industry to foster competition both in quality and price.
- Bolstering the technical progress of the industry by taking into account the research and development contributions by manufacturers.
- Bringing into play the diverse viewpoints both as to design and application of equipment, thus providing long-range economies not measured by initial price.
- Maintaining a strong and vigorous national economy through stable employment and reasonable profits for suppliers.

Through its own achievements the electric utility industry has come to play a leading role in the business and industrial community. Its actions at all times must be worthy of that role because of the prestige and influence that accompanies the responsibility.

The role can not be carried out by the simple use of shrewd but short-sighted purchasing policies. Purchasing, like the utilities' service activities, must be built on solid and enduring foundations. It must serve the broad public interest.

It is only when these factors are duly considered that the industry is in a position to determine when a bargain is truly a bargain.

## Ride That Range Campaign

Sample promotional materials for Edison Electric Institute's fall range campaign—the fifth in EEI's coordinated series for 1955—will go in the mails next week for utility executives. From then until the campaign swings into action in September, it will be up to every utility to get together with its dealers and distributors to mobilize local merchandising machinery.

Nationally, the manufacturers already have their advertising in the works. Consumer and trade magazines are expected to lend heavy editorial support. From all indications, the electric range will get a promotional and publicity splash not seen since the heyday of P. T. Barnum.

All this is in keeping with the idea behind EEI's coordinated appliance promotions: To achieve greater market penetration by getting everyone to promote the same appliance at the same time.

With national promotions of these promised proportions, market resistance can't help but be overcome. A softening like this makes it a setup for sales that the utility and its local allies can't afford to overlook.

How good are the campaigns? That, of course, depends on the local effort put into it. Union Electric Co's Bob Coe, chairman of EEI's Residential Promotion Committee, delivered some fetching figures at the Institute's recent sales conference. A few examples: Florida Power & Light's sales were 123% above quota in last fall's range campaign. Commonwealth Edison sold 3,000 in a month and a half. Atlantic City Electric sold 1,000. Two other companies doubled their sales in a dryer campaign last year.

ELECTRICAL WORLD supports these coordinated campaigns . . . range, water heater, housewares, all of them. From all reports, there will be a lot of talk about the electric range come September—the kind of talk that can lead to sales. Why not get in on it?

## A Meaningful Statistic

Our chart atop the next page gives the weekly output of all electric utilities in the U. S. up through the week ended May 7. For much of this year it has been running in the neighborhood of 15% above the corresponding weeks of last year.

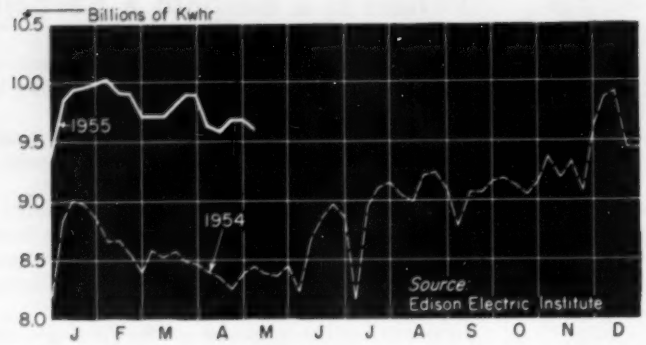
That is a true picture of electric power output, but it does not tell the whole story. The rapid rise of the Atomic Energy Commission as a consumer of electric power is largely responsible for the tremendous increases over last year. This one customer, drawing power primarily for its gaseous diffusion plants at Oak Ridge, Tenn.; Paducah, Ky.; and Portsmouth, Ohio, accounted for some 7.4% of the total U. S. output for a recent week. Excluding the AEC take, the rise over the previous year would have been 11.3%. With the AEC requirement, gain was 15.6%.

As the AEC is served primarily by two electric companies and one federal agency, the total U. S. output statistics might be misleading for anyone attempting to compare them with previous years, or use them in gauging general business activity.

As another service to our readers, ELECTRICAL WORLD has initiated a new service of estimating the weekly AEC requirement apart from the total output. You will find our estimate in a note beside the output chart.

# THE ELECTRICAL WEEK






## OUTPUT

**Week Ended May 7**
**9,586,000,000 Kwhr**
**Up 13.6%**

Atomic Energy Commission requirements — 720,000,000 kwhr (Electrical World estimate) Excluding AEC, output increase was 9.2%

Per Cent Change from Previous Year

| | Total US | New Eng. | Mid. Atlan. | Cent. Ind. | West Cent. | South-east | South Cent. | Rocky Mount. | Pacific NW | Pacific SW |
|---|---|---|---|---|---|---|---|---|---|---|
| May 7 | +13.6 | +3.6 | +6.6 | +17.9 | +4.4 | +21.1 | +16.2 | +5.9 | +11.4 | +6.6 |
| Apr. 30 | +15.6 | +12.7 | +9.7 | +20.0 | +5.0 | +22.6 | +10.5 | +7.6 | +13.0 | +12.3 |
| Apr. 23 | +17.4 | +11.2 | +10.6 | +21.1 | +6.4 | +26.4 | +14.9 | +8.4 | +16.6 | +12.2 |

Seasonally Adjusted Index 191.7 Week Ago 192.1 Year Ago 169.2

**The Issue's News Highlights . . .** Advance report of EEI's 17th Semi-Annual Power Survey of nation's capability, peak load, and reserve, estimated through 1958 . . . Annual APPA convention plugs nuclear energy as white hope of utilities in expanding market, recommends federal atomic plant as yardstick for private plants . . . Idaho Power's low dam on Snake River is favored in FPC examiner's report . . . Exclusive EW interview with NEMA's new managing director, Joseph F. Miller.

**Atom Power:** Private industry will spend about $300 million on atomic energy research in next four years, according to report by Atomic Industrial Forum, Inc. Report also sees: Three to five million kw of atomic power built before it competes economically with conventional power; $7.5 billion invested in reactors by 1965 . . . Participating members in Nuclear Power Group, Inc have approved group's proposal to AEC to build 180,000-kw, $45 million nuclear power plant in Illinois. Reactor will be dual-cycle boiling water type . . . AEC reports "promising" results for producing atomic power economically from "liquid metal fueled reactor," and "organic moderated reactor." One of these, says AEC, might solve corrosion problem in reactors. Units are in addition to five types AEC is testing under five-year program.

**Boston Edison** and UWUA-CIO have signed agreement providing 4¢ an hour wage increase plus fringe benefits . . . Ohio PUC is considering the agreement between Ohio Edison and Toledo Edison to exchange transmission and distribution lines and about 6,000 domestic customers in Sandusky and Port Clinton areas.

**EEI** Purchasing and Stores Committee at meeting in Birmingham last week elected as its new chairman W. M. Holls, purchasing agent, Baltimore G&E. Committee was told that recent survey of 57 electric utilities showed 25 are using and nine are considering using repeating requisitions for reordering material and equipment. Another survey showed purchasing agents of 12 utilities lean toward progress payments on purchase of heavy equipment. Price escalation on long lead time items came in for pointed criticism.

**California Electric Power** has offered City of Riverside $7.3 million for its municipal department of light. Among other things, company has promised no increase in rates for at least five years. Issue will go to voters if enough signatures are obtained on petitions . . . Bonneville Power Administration will make available its "backbone transmission grid" to builders of "partnership dams" like Priest Rapids or John Day. Administrator William A. Pearl says his staff is working out wheeling cost formula for this service on reimbursable basis.

## NEWS OF THE INDUSTRY BRIEFLY TOLD

**Off the Washington Wire . . .** Army's Board of Engineers for Rivers and Harbors takes up Niagara redevelopment at meeting this week. It will consider its decision on the recommendation of engineer in charge of hearings held in Buffalo last March . . . Installed capacity at Army Engineers' 22 dams passed has passed 3 million kw with new 40,000-kw unit now operating at Lookout Point Reservoir, Ore.

**Proposal** of 254/440Y v as a standard for all classes of service by EEI's task force won strong support at recent Detroit meeting of Transmission and Distribution Committee. Ebasco's W. R. Bullard urged it to guide "gradual drift" to higher voltage. GE's D. K. Blake qualified his previous preference for 120/240 and switched to 270/480Y. And R. F. Lawrence read a Westinghouse statement urging adoption of single standard in this voltage range for residential and commercial service.

**St. Lawrence Power:** First four contracts for purchase of St. Lawrence River power have been endorsed by potential purchasers following hearings before N. Y. State Power Authority last week. Contracts are Aluminum Co of America for 239 Mw; State of Vermont for 100 Mw; City of Plattsburg, N. Y., for 30 Mw; and U. S. Air Force for 10 Mw. Niagara Mohawk offered to provide transmission to Vermont, and together with N. Y. State E&G offered transmission to Plattsburg and USAAF. Rochester G&E suggested that private utilities buy all project power, except that sold to Alcoa, Vermont, and other states, if any, at a demand and energy charge no greater than that required by other contractors. Cost to four prospective buyers is $12 per kw per year plus 2.67 mills per kwhr, or about 5.5 mills per kwhr at normal load factor. To this must be added transmission charge of at least 1 mill per kwhr depending on location of delivery point.

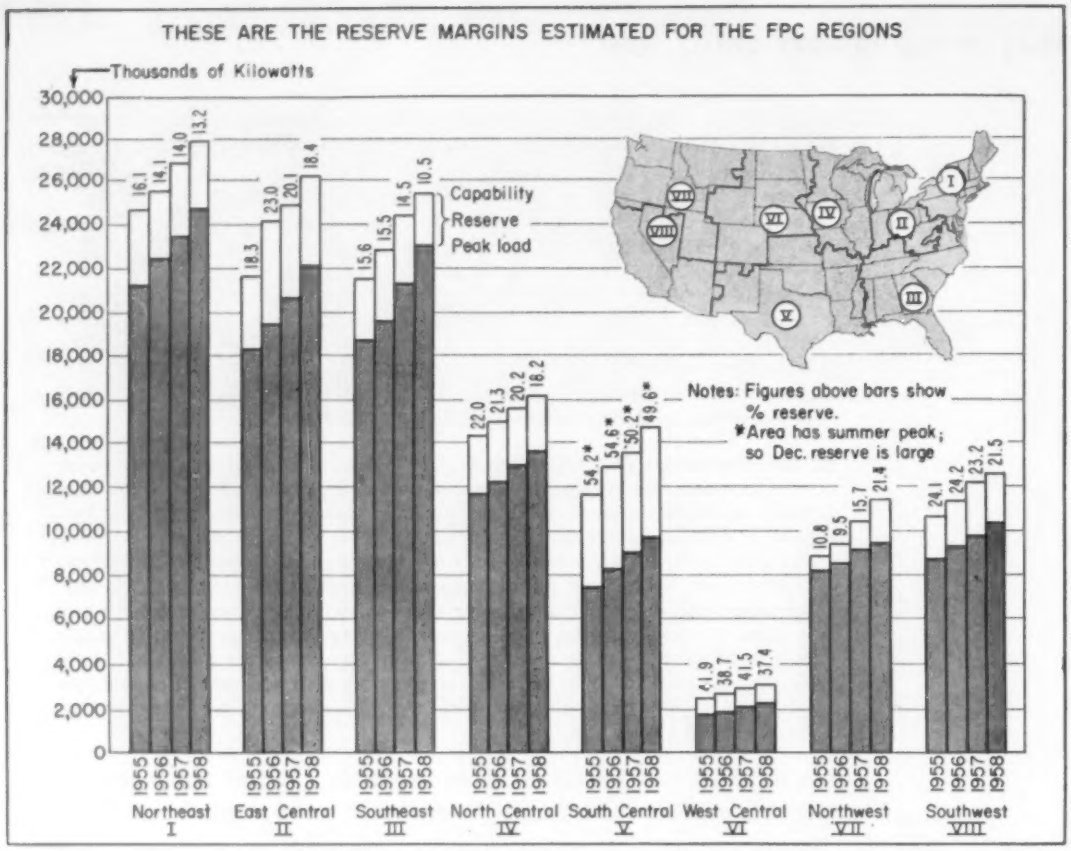
**Con Edison** last week awarded to GE the contract for a 300 Mw turbine generator unit for a projected $65 million extension to its Astoria plant. This unit, to be Astoria No. 3, will have a maximum rated capability exceeding 330,000 Kw. The turbine will be a cross-compound machine with a double-flow exhaust. Steam flow will be 2,400,000 lb per hr, throttle pressure 2,000 psi and initial temperature 1,050F with one stage of reheat at 1,000F. Boiler contract has not been placed.

## WHAT THE ATOM BLAST DID TO ELECTRICAL FACILITIES

*(An on-the-spot report from EW's editor F. Kovalcik)*

**Yucca Flat, Nev.,**—Electrical facilities 4,700 ft from ground zero suffered surprisingly little damage in the nuclear blast of May 5. There was no apparent damage to installation at 10,500-ft line. One tower in 66-kv line at 4,700 ft failed structurally. One side of one load regulator buckled but all other major equipment at 66/11/4-kv substation appeared in operable condition. Two connections were broken; two insulators chipped. Estimated 30% of secondary No. 2 aluminum was down. Four of 15 wood poles snapped at or near base. No poles guyed with wires parallel to direction of blast were down. Several pole or platform mounted transformers were knocked down. Aluminum 11-kv lines and copper 4-kv open wire lines were unbroken. Damage to arms, insulators, and hardware was minor. Aerial cable appeared undamaged. Two of four houses served by installation totally destroyed. Two of remaining structures are not typical of present construction in country. It was estimated power could be restored on system within eight hours. Of light industrial structures, all three at 6,800 ft from ground zero would require major rebuilding or replacement. Only one at 15,000 ft could be put to use immediately. Details in May 23 issue.

**More News About People page 196**




EEI's 17th Annual Power Survey . . .

# Predicts Slight Reserve Decline '55-'58

Electric power suppliers plan to increase their capability to 138,040,000 kw by the end of 1958, bringing the margin of capability over peak load for the entire nation to 19.3%, the Edison Electric Institute has announced in its 17th Semi-Annual Electric Power Survey.

The predicted reserve for 1958 is somewhat lower than the 20.9% forecast for December of 1955. This latest estimate coincides closely with the 1955 year-end reserve of 21.5% which EEI forecast last fall.

The December 1954 reserve was 21.0% and the forecast for 1956 is 21.3%.

The 1955 reserve margin is based on a capability of 116,499,000 kw and a peak load of 96,348,000 kw. The margin for 1956 is based on a 124,043,000 kw estimated capability and peak load of 102,291,000 kw.

The EEI survey indicates the margin will be 20.5% in 1957 with a capability of 131,304,000 kw and a peak load of 108,939,000 kw. Adding still more to the national total, electric power suppliers are expected to bring the reserve figure in 1958 to 19.3%, capability to 138,040,000 kw, and peak load to 115,751,000 kw.

Throughout the report, figures for 1958 are tentative since, according to EEI, scheduling of capability for that year has not been completed.

Should median hydro conditions exist for the nation, as EEI assumed in preparation of its report, no section of the country would experience power shortages over the next three years.

But in event of low water conditions, as in the past year, the Pacific Northwest (western division of Federal Power Commission Region VII) would encounter minor deficits for this year and 1956.

Following a trend in the South Central region, peak load there will occur during the summer months. The summer reserves are less than half the region's winter reserves.

Regions II and III will be affected by the atomic energy program. Other than for these two regions, forecasted capability and load are commensurate with the normal growth expected.

The EEI report indicates that reserve capability is sufficient to meet anticipated loads in the nation.

The new goal of 150-million kw capacity, set by Office of Defense Mobilization, for the end of 1958, is considered an "extension rather than an increase;" a mobilization objective, not an actual estimate of construction. Says an ODM official, "The 150-million kw figure is our estimate of what we'd need to fight a full-scale war."

CHET HOLIFIELD

**Public Power advocates plug nuclear energy as white hope for utilities in expanding market, recommend federal atomic plant as yardstick. These were views presented at . . .**

LISTER HILL

# . . . APPA's 17th Annual Convention

Atomic power is the white hope of both public and private utilities in supplying an ever-growing market for electric energy in the United States, the 12th annual convention of the American Public Power Association was told recently in Jacksonville, Fla.

Although atoms for power occupied the spotlight for most of the convention's three days, the 500 delegates and speakers took time out to elect new officers and to flay away at favorite, time-worn targets.

### Association Elects Officers

Newly elected officers of the association are: President—William E. Hooper, general manager of City Power, Water, & Gas Department at Sheffield, Ala.; vice president—William S. Peterson, assistant general manager and chief engineer, Department of Water & Power, Los Angeles; executive vice president—Owen Hurd, manager, Benton County Public Utility District, Kennewick, Wash.

On the convention's firing range, barbed comment and criticism were hurled at Dixon-Yates, the partnership development program, preference qualifications, and destruction of the so-called yardstick.

Senator Lister Hill (D-Ala.), in his keynote speech, emphasized the part which publicly owned utilities play in setting a yardstick against which to measure private utilities' earnings. Without public power groups, he declared, the federal government and state commissions would have nothing by which to measure the performance of the private utilities.

Rep Chet Holifield (D-Calif.), a member of the Joint Congressional Atomic Energy Committee and, like Hill, an ardent Dixon-Yates foe and public power advocate, used the convention platform to air the first public criticism of Consolidated Edison Co of New York, Inc, which plans a new privately financed nuclear power plant on the Hudson River.

Of this endeavor—praised in Congress by both Republicans and Democrats as the first concrete step toward truly competitive atomic power—Holifield said, "The Consolidated Edison Co of New York has applied for a 40-year license to construct and operate a 250,000-kw atomic power plant. . . . More than likely, if this project is approved, the electricity customers of Consolidated Edison will find their rates increased to finance the atomic experiment."

Holifield agreed with Hill that the government should undertake to build a federally financed atomic power plant to furnish electricity to needy public power groups and to serve as a power cost yardstick in the atomic age.

### Con Ed Answers Charges

From his New York office, James F. Fairman, Con Ed's vice president of engineering, later issued a statement which said that "studies (for its atomic installation) indicate an initial production cost . . . of nine mills a kwhr. This figure is better than the company's average generating cost today."

He added that the cost of nuclear fuels will probably go down, while the cost of conventional fuels, dwindling in supply as demand increases, probably will go up.

R. L. Schacht, general manager of Consumers Public Power District of Columbus, Neb., and immediate past president of APPA, reported an "apparent indifference and lack of understanding of the concept of public power as distinguished from private power" on the part of the Hoover Commission task force on water resources. He indicated that the task force's forthcoming report would work to the disadvantage of publicly financed power organizations.

### Radin Presents Report

Alex Radin, APPA general manager, presented his annual report to the organization. In it he mentioned: APPA's work to iron out problems which have arisen in applying preference to marketing of power from federal reactors; uneasiness about plans of New York state for marketing St. Lawrence River power; APPA's determination to fight the Dixon-Yates contract. The Dixon-Yates plant, Radin said, is "still far from being a reality."

Major resolutions, approved by the convention, called for the following:

Approval of financing plans for Tennessee Valley Authority by Congress and Budget Bureau.

Cancellation of Dixon-Yates contract and congressional authorization for a new TVA plant of this size, or denial by Congress of funds to complete the contract if Atomic Energy Commission won't cancel.

Congressional rejection of Hoover Commission's recommendation for Rural Electrification Administration.

Congressional authorization for funds to reimburse "consumer-owned electric systems" for highway relocation.

Abolition of the tax amortization program and legislation to insure that "all benefits from past tax write-off programs flow to the electric consumers."

# Idaho Power Gets Support

**FPC examiner recommends construction of one of company's proposed three low dams for Hells Canyon; sees approval of the federal high hydro dam as "completely useless action"**

Federal Power Commission Examiner William Costello has ruled in favor of Idaho Power Co construction of Brownlee Dam, the biggest project (360,400 kw) in the company's three-dam plan for hydroelectric development of the Snake River in Idaho.

In so doing, Costello rejected, for the time being, the company's plans for two companion dams at Hells Canyon (272,000 kw) and Oxbow (151,000 kw). His decision also precludes construction of an 800,000-kw federally financed high dam project at Hells Canyon.

Costello's ruling is subject to veto, approval, or amendment by the commission. Technically, it's just another step in the government's decision of whether or not the private utility should receive a license to develop the Snake.

The examiner's ruling conflicts with the views of all parties to the proceedings. The company has asked for a license for all three dams. Intervenors have asked that it be denied. The commission's staff has advised that a three-dam license go to the company, and that it be required to build Brownlee first. And, while not legal parties to the proceedings, congressmen and politicians at every level have fought the issue on both sides.

Costello's 79-page report made it clear he weighed the company's proposals on its own merits. He did not actually compare it to the proposal for a high federal dam, but rather found that Brownlee's construction would fulfill prime federal objective in development of the comprehensive plan for the Columbia River Basin, then went ahead and judged the plan as to its financial feasibility, engineering practicality, and service to the company's area.

He came to the conclusion that this dam alone would satisfy the major aims of the government, as set forth in Army Corps of Engineers' reports, and that the other two dams in the utility's plan would not be justified for several years.

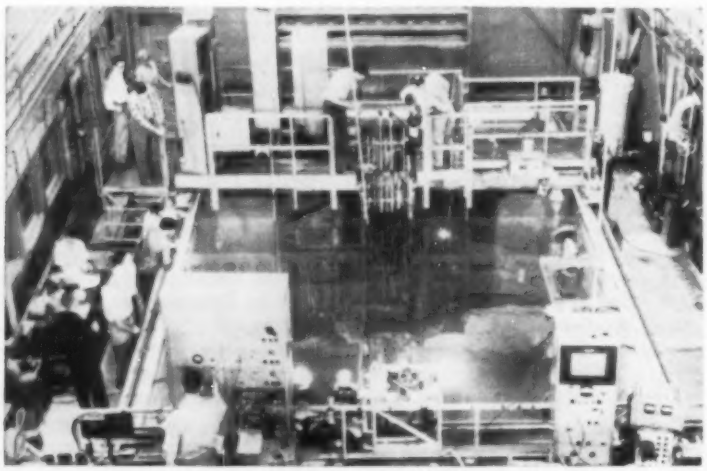
His decision left open the possibility that the company could apply later for licenses to build the other two dams.

Here are some of Costello's most important findings and conclusions:

- The added power, over the three-dam plan, which could come from a high federal Hells Canyon Dam—16,600 kw of capacity—would be economical, and therefore federal planners would choose this plan.
- But the likelihood of Congress authorizing this project within a period of time necessary to enable it to help meet threatening power shortage is so remote that a recommendation to this effect would be a "completely useless action."
- Therefore, if FPC found in favor of a high federal dam, and ruled against the company's plan completely, this action would freeze the middle Snake for hydro development for a long time.
- Since there is now only a market for Brownlee power—through the company's own system—it would not be in the public interest to license the other two. Costello found that other power users in the area could not pay the price for Oxbow and low Hells Canyon power, if they were part of an overall development project, despite the fact that they would be cheaper individual producers. (He estimated Brownlee's unit power cost at about 7.6 mills, compared with the 6.6 mills for the three dams together. But he also found no reasonable evidence to show there are utilities within transmission distance who would be willing to buy surplus power from the three-unit project at the estimated at-site cost of 6.69 mills per kwhr.)
- Cost of the three-dam project would be $191 million—an FPC staff estimate Costello adopted. For Brownlee, the company would spend $95.4 million, and be able to produce almost half the power planned for all three. Cost of the federal high dam would run to more than $380 million.

Brownlee would be located in Washington and Adams Counties in Idaho, and Mahleur and Baker Counties in Oregon, about 9 miles downstream from Robinette, Ore. It would have a maximum height of 395 feet, and be approximately 1,700 long. It would rank among the 15 highest in the

(*Continued on page* 95)



# AEC's Pool Reactor Declassified

Classified swimming-pool reactor was revealed for inspection when 32 foreign scientists and newspapermen recently visited the Atomic Energy Commission's laboratories at Oak Ridge, Tenn.

Reactor is used chiefly to test shields designed for protection of workers at atomic installations. Public unveiling was a part of President Eisenhower's atoms-for-peace program.

# Miller, New NEMA Head . . .

**. . . tells Electrical World of his confidence in future growth of electric manufacturing industry, and of his plans for keeping the NEMA organization abreast of changes in the field**

Joseph F. Miller, newly appointed managing director of the National Electrical Manufacturers Association says he is "proud to be associated with the electrical manufacturing industry."

Electrical equipment manufacturing, Miller told Electrical World in an exclusive interview, "is a wonderful industry." Its products are among the great contributions of the United States to civilization generally. It has been and always will be a leader in this country. Its future prospects for expansion are virtually unlimited. When you consider some of the problems of other industries, you can appreciate what a great industry this is. Where else do you find an industry that has been growing at an average rate of about 10% a year with no signs of any let-up?"

### Praises Predecessor

Miller, a soft-spoken man with a ready smile and a sense of humor, comes to his new post with great admiration and respect for the work of his predecessor—William J. Donald who retired April 30. Donald had held the position for close to 21 years.

"Donald did a terrific job for NEMA," says Miller. "He knew more about running a trade association than any man alive, and I intend to try and run it the way he did. If I can do anywhere near the job he did, I will be happy."

Like Donald, Miller said, he is a believer in rigid budgetary control. "When you are dealing with other people's money, you have to be careful."

Before coming to NEMA in August, 1953, as recording secretary of the Wire and Cable Section, Miller had been serving as director of the Copper Division, Metals and Minerals Bureau, of the National Production Authority, Department of Commerce, since September 1952. He was appointed Deputy Director of the Copper Division on July 9, 1952, and also served in the capacity of Deputy Assistant Administrator of the Metals and Minerals Bureau.

Prior to assignment to the Copper Division, he had been an attorney in the office of the NPA General Counsel, specializing as counsel for the Copper Division and the Tin, Lead, and Zinc Division.

From 1942 to 1946, Miller was counsel for the Defense Plant Corp, a subsidiary of the Reconstruction Finance Corp. In 1946, he was appointed director of the Legal Division, Regional Office for Real Property Disposal of the War Assets Administration but resigned to re-enter private law practice the same year.

Born in New York City in 1907, Miller is a graduate of Princeton University and Harvard Law School. He was admitted to the New York State bar in 1932 and immediately engaged in private law practice in New York City.

Miller's work with NPA led to his coming to NEMA. As Director of the Copper Division, he successfully and diplomatically handled copper allocations between segments of the industry which were unhappy about the copper controls.

Does Miller contemplate any major changes in NEMA's operations?

"No," he says. "What changes there will be, will be made slowly, and they will be mostly internal—greater emphasis on public relations, changes in the meetings procedure, some staff additions. We hope to put on more of a NEMA program in Atlantic City. But this is something that will come in the future."

### Plans for NEMA

With regard to public relations, the NEMA executive says "NEMA has been hiding its light under a bushel. Back in the 30's and 40's trade associations were looked upon with suspicion. But today the atmosphere toward them has changed considerably. It is generally recognized that they accomplish many things. There is no longer any need for a continuing passion for anonymity on our part."

Miller adds that NEMA does not

*(Continued on next page)*

NEMA need not hide its light...

Under a bushel, and we plan...

More active public relations

## New NEMA Head

*(Continued from previous page)*

plan to hire public relations counsel. "We have the facilities available in our organization. All we need is a change in policy. We hope to do more with and for the trade press. The complexity of business today requires many media of communication. The trade press fills many needs which we cannot possibly take care of in our own internal publications."

Miller does not see any other specific changes needed in NEMA immediately. But, he says, "as the electric industry expands, we will have to expand our scope. Last year we added a section to deal with electric house heating. Next year it may be the heat pump or atomic power equipment."

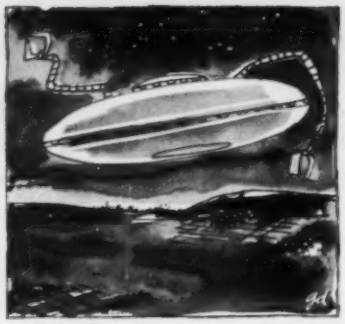
Does Miller feel that the Adequate Wiring Bureau, as has been suggested in some quarters, should be separated from NEMA and become an independent organization?

"The idea is a good one, but the problems involved in separation would be almost insuperable.

"Certainly, it would take away one of our major problems, but it would not be in the best interests of the bureau. If you establish a separate organization, immediately you have the problem of fund raising, and this takes time and energy. If people have to start worrying about money, they can't be expected to do their best work. Is is questionable whether you could get the same caliber of people to work under those conditions that we have now working under NEMA. Or to put it another way, you would have to pay more than we are paying now for the same high quality of work we are getting."

## Cowlitz Dams in Court

Two aspects of Tacoma City Light's proposed $146-million development of the Cowlitz River are being threshed out in court. Washington State Game Commission has brought suit in Thurston County to block construction of Mayfield and Mossyrock Dams because of damage to fish supply in the river. And Tacoma City Light has initiated condemnation proceedings in federal court at Tacoma against owners of 2,150 acres of property needed for the Mayfield hydro dam development.



## A-Bombs or Martians?

Salt Lake City newspapers and police switchboards hadn't been so swamped with urgent telephone calls from frightened citizens since Orson Wells broadcast his Martian invasion.

A few of the frantic callers reported that it sounded like someone was blasting up the neighborhood. One thought it was "a locomotive running behind my house." But to most it sounded like airplanes.

The Salt Lake Tribune reported that one caller asked breathlessly, "Are they ours, or is this it?"

Cause of all the tension was a by-product of operations at the Utah Power & Light Co's Gadsby steam plant. The sound of compressed air, used to clean out steam and water lines and test boiler safety valves, had been intensified and it's source diffused by reverberations from surrounding mountains.

## New Meeting Policy Set by NFEC Steering Unit

National Farm Electrification Conference is abandoning its sponsorship of annual conventions in favor of smaller conference-type meetings.

This was the major action taken by the NFEC steering committee meeting in Washington, D. C., recently. James R. Cobb, manager of power supplier sales, Frigidaire Division, General Motors Corp, was elected general chairman of NFEC at the Washington meeting. Other newly elected officers are W. J. Ridout, editor, Electricity on the Farm Magazine, first vice chairman, and H. S. Pringle, Extension Service, Agriculture Department, second vice president.

In the future, conventions will be called only when the steering committee decides a national forum is necessary to present or to discuss some highly important subject. The smaller conference-type meetings will probably be called once or twice a year at the discretion of the chairman. Provision was also made for year-round operations for four project committees.

Although attendance at future meetings will be limited primarily to members of the Steering Committee and working task groups, others interested in farm electrification may be invited by conference participants.

NFEC serves as a forum for discussion of subjects on farm electrification. Some 15 national organizations participate in NFEC business on an active basis. These participants include national farm organizations, federal agencies, power suppliers, electrical manufacturers, distributors, county agents, magazines, and other national bodies having an interest in farm electrification.

## Construction Plans Set for NW's Priest Rapids

The Grant County PUD of Ephrata, Wash., has revealed construction details of its proposed $375-million hydroelectric project on the Columbia River at Priest Rapids.

Plans call for construction to begin next year on a dam 75 ft high which would go into power generation in 1960. A second dam would be placed under construction in 1958 at Beverly, 15 miles upstream, and begin producing power in 1962. The two dams would provide a total 1.2 million kw, said G. A. Smothers, PUD manager.

## Idaho Power Support

(*Continued from page* 92)

United States. Its reservoir would run 57½ miles upstream.

If the commission does not review Costello's decision, it will become final by June 5.

Previous to release of the examiner's report, R. P. Parry, counsel for the Idaho Power Co, had testified before the Senate Interior Irrigation and Reclamation Subcommittee, winding up the week-long Hells Canyon hearings with a defense of his company's activities in the power fight.

When informed of the decision of the FPC examiner recommending only the Brownlee unit of the company's three-dam proposal, Parry said "I feel quite happy." He pointed out that the examiner rejected the two other dams (Oxbow and Hells Canyon) without prejudice and that they could be applied for later "when we need them."

Senator Wayne Morse (D-Ore.) said the examiner's report, "is about what I expected."

Morse commented that the examiner's "recommendation for a license for only one dam of the three Idaho Power Company dams is based on an assumption of congressional inaction that is beyond his authority to make. This places the responsibility for inaction squarely upon the shoulders of the President and this Administration."

## Approved for FPC

The nomination of 32-year-old William R. Connole to the Federal Power Commission has been approved by the Senate. He will succeed 12-year FPC veteran Nelson Lee Smith.

Connole at present is general counsel of the Connecticut Public Utilities Commission. Previously, he was an Interstate Commerce Commission attorney.

# NW Public Power Association

### Annual meet hears BPA's Price: U. S. must spend $3.5 million for NW power in ten years, advisory council reactivated

"Power needs of the Pacific Northwest for the next 10 years will require a total investment of at least $3.5 million for new dams, transmission facilities, and projects now underway," Byron L. Price, assistant Bonneville Power Administrator, told the annual meeting of the Northwest Public Power Association in Eugene, Ore.

"The requirement of around $1 million a day . . . compares to a federal expenditure of . . . less than $500,000 per day over the past 20 years," he added.

Regional power forecasts indicate residential and farm use of kilowatts, already 2½ times the nation's average, will more than double in the next decade; commercial and small industrial loads will be twice present demand; and large industries will use 70% more, the federal agency aide reported.

Price urged public distributors, obtaining federal power under the BPA preference clause, to seek more energy sources on their own. "Each and every kilowatt of generation developed by a preference agency will result in that much less drain on federal power upon which many of you are depending to meet your future requirements," he said.

Price announced that Administrator Pearl was reactivating the regional advisory council which had been inaugurated by his predecessor, Paul J. Raver. This organization, consisting of appointive members meeting on an area basis as well as holding semi-annual regional sessions, will likely be smaller than its predecessor.

Members, Price said, would be selected from nominees submitted by organizations, would represent the "broad cross section of Pacific Northwest interests and activities," and would serve for two years.

## Niagara Hassle . . .

### . . . over public, private development plans sparked by hot letter from Moses

Sparks spewed out again over proposed plans for development of Niagara River power when Chairman Robert Moses of the Power Authority of the State of New York recently whipped out a hot, three-page, single-spaced letter to Earle J. Machold, president of Niagara Mohawk Power Corp, Syracuse, N. Y.

Flint-stone for Moses' sparks this time was the contention by Niagara Mohawk and four other utilities seeking rights to Niagara development that no power shortage exists in New York state.

Moses challenged the claim as "your latest power propaganda." If there is no shortage, Moses asked, why is future power from the St. Lawrence River already in such demand by both utilities and industries.

"Let's be sensible," wrote the Power Authority head. "You gave up the fight to get the St. Lawrence . . . In the end, you are not going to be allowed to exploit the Niagara either." The utilities, Moses contended, want the sizable profits expected from Niagara development.

Machold's well-tempered, five-paragraph reply acknowledged that the present power supply should be increased, but added that private interests should do it. He made no attempt to answer in detail any of Moses' charges. And he gave no indication that the utilities would back down in their struggle to develop Niagara power.

New York State Electric & Gas Co —another member of the five-company team seeking power rights to the Niagara rapids—also indicated that it would not give up the fight. At the utility's annual meeting in Ithaca, President Joseph M. Bell, Jr, declared his company would continue to oppose bills in Congress proposing public power development.

However, he also stated that his utility would consider purchasing St. Lawrence power from the authority for benefit of residential customers.

# Ted Locke Looks at Utility Analysis

**Goodbody & Co specialist sees analyst linking investor, utility, and financial community where electric companies must go to raise expansion funds**

The breakup of most of the country's utility holding companies which took place in the 1940-50 decade resulted in the divestment of a big number of big electric and gas distributing companies whose common stock thus came into public hands for the first time. As a result, the work of the financial analyst in the public utility field has assumed greater and greater importance.

To the analyst fell the task of explaining to investors the relative attractiveness of these many new-to-the-market operating companies. And he has had to aid these companies and the balance of the utility industry in raising the new money for their large construction programs through sale of stocks and bonds to the public.

In this development some outstanding men have come to the top among public utility security analysts. One of these is Theron W. Locke, public utility research specialist of Goodbody & Co, known to his friends as Ted Locke. Because there still seems to be some confusion as to the work of the utility analyst, Electrical World interviewed Locke to learn some of the facets of his work.

When a utility company official recently wrote to Locke to ask him for information about his method of selecting electric utility securities as to quality, Locke replied, among other things, that "it is men and not ratios that make a great utility." This piece of advice is an important clue to Locke's approach to the work of being an analyst.

But Locke maintains that the biggest contribution the analyst can and should make in this field is to do all he can to improve the understanding and flow of information between the investor and the individual utility and between the utility and financial community. He has pursued this objective with seemingly boundless energy and enthusiasm, and often without any apparent direct rewards.

He points out that most operating utilities, until the breakup brought about by the Public Utility Holding Company Act of 1935, were comparative strangers to the investing public and to the financial community. Locke has contributed substantially to changing this situation.

Aside from these aspects, Ted has been more than a missionary for the utilities in his firm conviction of the excellence of electric utility stocks as an investment and in the future growth prospects of the industry.

"There are growth prospects in every public utility I know, and there's no other industry you can say that about," Locke told Electrical World. He can back up a statement like this with ample evidence—the fruits of years of delving into the utility industry with the thoroughness of a scientist analyzing a new chemical.

When he analyzes a company, says Locke, "I work as if I were a part of that company." About his thoroughness there is ample proof. When visiting a utility recently, the president said to him, "Ted, you can estimate the earnings of my company more accurately than most of my own people."

Born in Iowa, and trained in the Middle West, Locke took his masters degree in public utility finance at

Northwestern University. While at college he was gaining some practical experience in the operations of a utility. He financed part of his studies by working as a meter reader and on the repair crews for a utility.

He has spent the last 26 years in Wall Street, mostly in utility work. Locke gained invaluable insight into the money market during the depression while working as chief statistician for the Manufacturers Trust Co in New York.

Ted joined Goodbody in 1947, an event he looks upon as a happy marriage. Goodbody is one of the important dealers in utility securities —Locke's specialty. Many of Goodbody's clients are large pension, investment, and trust funds, and his recommendations are likely to form the basis for purchases of stocks running into millions of dollars.

**Reports On Utilities . . .** In addition to this phase of his work, Locke writes major studies on utility companies. These exhaustive reports, published frequently but not on a definite schedule, go to Goodbody clients and other interested persons. Mailings frequently run above 20,000. Interspersed in studies of individual companies are such reports as "A Comparison of Eleven Electric Utility Growth Stocks," "Utility Stock Splits," "A Comparative Study of the Interest During Construction Credit for 86 Electric Utility Companies," and "Ten Utility Stocks for Income."

Locke has never been reluctant to share his knowledge and experience with the younger men coming along in Wall Street. For 12 years he taught utility finance and security analysis at the New York Institute of Finance.

**Leader In Analysts' Society . . .** With his desire to improve the understanding between utility companies and investors, it was natural that Locke should have been one of the leaders in the New York Society of Security Analysts. This society now has affiliates in several major cities in the country.

For three years he was chairman of the Utility Division of the New York Society of Security Analysts. He was responsible for bringing leading utility executives to the society's weekly luncheon meetings. These luncheons have grown in popularity to such an extent that a good many utilities today regard them as an essential part of stockholder relations.

But how does an analyst set about examining the financial heart and soul of a utility? Locke revealed several phases of this work in answers to the following questions:

**Q.** What do you look at in analyzing a utility?

**A.** Management—above all—general management and financial management. Then I take territory, regulation, public power, and financial ratios—in that order.

**Q.** You don't give much weight to financial ratios?

**A.** No, my method might be described as 70% management and 30% figures. Investors who buy by ratios alone are buying blind.

**Q.** What do you do about keeping in touch with management?

**A.** I talk to about 12 to 15 utility company presidents every week. From three to five of these I see personally, and I'm in touch with the others by phone. In addition, I spend about eight to ten weeks a year visiting different utilities.

**Q.** How do you go about rating management?

**A.** This is a composite of many impressions and ideas. It takes more than acquaintance with top brass to find out how good management is. I like to get out into the territory and meet the district managers and others. I like to hear what the men think of bosses and what consumers think of the company. These are some of the things that tell you how good management is. Additionally, financial policies are extremely important.

**Q.** Do you have any general comments about regulation?

**A.** It would seem that proper regulation should envision at least a 6% return as a floor as well as a theoretical ceiling. If a utility company is going to be restricted to a certain return, then it should be allowed to earn that return at all times without having constantly to defend its right to do so. Investors who have supplied the hundreds of millions of new capital that has enabled the industry to double its capacity since World War II have a real interest in this problem of regulation.

It might surprise some regulators to learn how relatively easy it is for in-

Good management is vital

6% should be the floor

Ratio buying is blind buying

Harold Goodbody, Locke confer

Ted keeps posted by phone. . .

visits to utility plants . . .

close watch of news tape

vestors to step out of a utility situation through sale of their security holdings. And nothing we know of could make it harder for a company to get new money than a consistent program of selling by present bondholders or stockholders of a company's outstanding securities.

**Q.** Could you give some of your ideas on public power?

**A.** I consider the continuing expansion of public power still the greatest threat to the investor-owned utility business in the U. S. This threat has not been eliminated with the present Administration. And co-ops are one of the most harmful forms of public power. It is true that they are somewhat circumscribed now, but they are harmful because they come in on a subsidy. Where there is a public power situation adjacent to an investor-owned company, it can have a bad effect on future earnings and growth of that company.

**Q.** What are some of your ideas as to financial policy?

**A.** From the common stockholders viewpoint the best financial policies are those that lead to a commensurate increase in per share earnings as the company expands. And the best growth in per share earnings can generally be accomplished by issuing as few common shares as possible and then only at the best possible price obtainable. Because of the dilution of earnings a utility should avoid the use of rights on its common stock sales whenever possible. Rights are in reality a return of capital and not income. Except where state laws require them they should be avoided. Similarly, I don't favor sizable stock dividends. They tend to cause a dilution in per share earnings.

**Q.** What payout do you favor for dividends?

**A.** The average dividend payout for the electric utility industry is 75%, and I don't feel that a company should go beyond this.

**Q.** Which do you prefer for investment, common or preferred stock?

**A.** I regard the preferred stock as a poor type of security for an investor to own in an inflationary period. A preferred stock never has a maturity, it doesn't have to be paid off, and it is generally callable. On the other hand, the utility common stock is becoming a preferred type of common stock. I see the time coming when more and more utility companies will use a capital structure composed of around 50% debt, some serial debentures, and 35% to 40% common stock. Serial debentures or debentures convertible into common stock cost less than preferred, and companies can use these tax savings to retire part of their debt.

With the greater acceptance of the utility common stock as an investment, the institutional investor is becoming the big buyer of utility common stocks. This could bring about a situation where we might have relative degrees of scarcity of certain utility common stocks having a high degree of investor acceptance.

Utility stocks are different from speculative industrial stocks. We mustn't forget that utilities are built to serve the consumer and not as a vehicle for speculation. The utilities' prime function always must be to give the best possible service to the consumer at the lowest possible cost. Good stock-minded management can serve both interests—the consumer and the investor—without sacrificing the rights of either.

**Q.** What do you think atomic power might do to the electric utility investments?

**A.** Atomic power is so new and its uses so involved that no one can tell what may come out of it tomorrow or next year. However, we know that for the present there will be little change in conventional utility power facilities except that the atomic reactor would replace the fuel burning equipment, representing only about 17% of total investment in a power plant. Furthermore, the expected expansion of the electric industry is so large that there should be no real fear that present investments would be imperiled by obsolescence. Even if a considerable number of nuclear plants were added each year, their percentage of total capacity would begin at a very low figure and grow slowly.

**Q.** Ted, what has been your principal aim in the last eight or ten years in your work in utility securities?

**A.** My chief efforts have been directed at improving the understanding between utility managements and investors. This has been the prime motive behind my work in the New York Society of Security Analysts, my teaching at the Stock Exchange, and in my dealings with hundreds of company officials and investors.

**Q.** Is there any single piece of advice you would consider important to the utility industry?

**A.** Yes. The industry must continue to strive for a greater unity of interest to guard against the threat of public power piecemeal encroachment. It is, for instance, as vitally important to companies in the Midwest that the Niagara Project not become another TVA as it is for those companies directly concerned.

**Planning ahead for growth . . .**

# Tucson Takes 14.4 Kv Underground

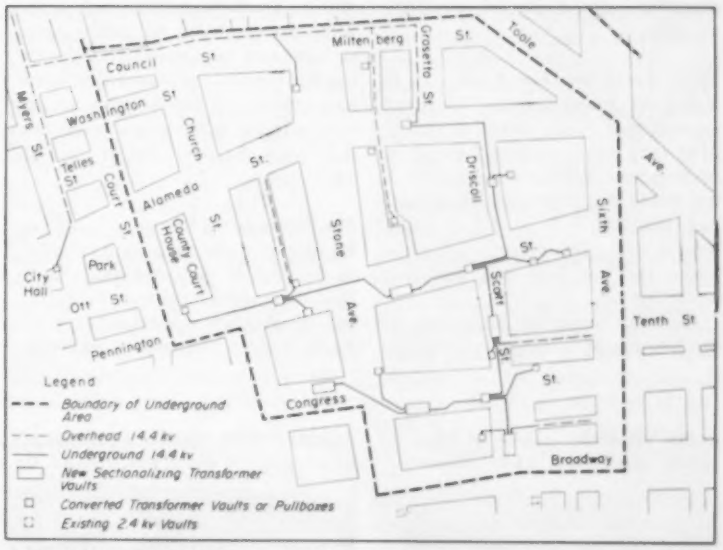
**N. M. LOVELL,** Vice President, Tucson Gas, Electric Light & Power Co, Tucson, Ariz.

Relocation underground of Tucson Gas, Electric Light & Power Co's distribution system in downtown Tucson is marked by:

**1.** A system design to allow economic expansion in any direction.

**2.** Flexibility to connect existing customer vaults and provision for additional load as modernization continues in the downtown area.

As part of a 25-year franchise renewal with the city, the company agreed to replace existing 2.4-kv overhead lines in the business district with a 14.4-kv underground system. Four years is the time allowed for completion of the first phase of the relocation, which will cost about $350,000. Under the franchise, any additional downtown area to be served from the underground system may be determined mutually with the city after present plans are completed.




**DOWNTOWN TUCSON has sectionalizing vaults for new 14.4-kv system. These vaults will allow for economical expansion of underground facilities in future**

**Availability Prompts Use of Aluminum . . .** Following the franchise renewal, Tucson GEL&P was advised under the Controlled Materials Program that existing adequate overhead lines could not be replaced by another system. CMP further stated that aluminum conductor would probably be available sooner than copper. The new system was justified on the basis of additional load resulting from remodeling and modernization of downtown commercial establishments. And because of a tight copper supply, the company decided upon aluminum for the first phase of the downtown Tucson installation.

Chosen for primary lines was a single-conductor, 250-MCM, 15-kv, non-leaded aluminum cable. Jacket consists of a 25/64-in. wall of synthetic oil-based rubber insulation covered by a 5-mil copper-nickel shielding tape with weatherproof asbestos braid overall. In the first phase of the relocation program 35,000 ft of cable were used.

Objectives of economic expansion in any direction and flexibility to utilize existing customer vaults are being met through the use of seven sectionalizing vaults. Five of these have been built, and the other two will be completed during 1956. Each vault will have two sources of supply, preferred

and emergency, from overhead 14.4-kv lines as shown in the accompanying sketch.

**Provides for 50% Load Growth . . .** Additional feed points will be established as load increases. One set of feeders, to sectionalizing vaults, will provide for a 50% growth in load. Three primary feeders are run in each duct line. Spare ducts, a minimum of one per run, have been installed to provide 50% additional capacity.

In the vaults, primary voltage is stepped down to either 120/208 v or 120/240 v to feed existing customer loads. Secondary lines from distribution points are single-conductor, 600-MCM, 600-v aluminum cable with conventional insulation; about 24,000 ft has been installed. New vaults will be provided on this secondary system, where existing vaults are inadequate. However, old vaults formerly fed from the 2.4-kv overhead have been retained as secondary distribution points or, where space permitted, were converted into 14.4-kv vaults.

**Ducts Are Under Gas Lines . . .** In laying out routes for duct lines and locating new vaults, available records of existing water, sewer, gas, and other underground facilities were studied. It was found that a probable clear space was available 3 ft to 4.5 ft below ground level. This space is just under water and gas lines and just over sewer lines.

However, complete knowledge of the location of underground facilities was lacking. Therefore, to decrease the possibility of injury to the electrical system due to work or trouble on other utilities, it was decided to enclose all ducts in a concrete envelope with a minimum 4-in. thickness. Ducts are 4-in. ID asbestos fiber composition with thick-wall construction. Approval was received from the cable manufacturer to put all three phase cables in a single duct. Thus, cables take up 55% of duct volume.

No difficulties were expected or encountered during pulling-in of the cables. After lead lines were blown through ducts with compressed air, they were used to pull a ½-in. steel pulling cable by truck winch. A duct mandrel was pulled through the lines to prepare the surface for the cables.

Attached to standard extra-length cable grips, three cables were pulled simultaneously by truck winch. Cable was delivered in 1,002-ft lengths to accommodate the pulling schedule. The longest length pulled was about 480 ft, with most pulls averaging about 400 ft. Upon recommendation of the cable manufacturer, no pulling soaps or lubricants were used. To allow for cable expansion and contraction under load cycling, allowances are made for 90-deg bends in vaults and manholes. All bends are made on at least an 18-in. radius.

**No Potheads on Risers . . .** Existing 14.4-kv overhead lines were extended to the edge of the downtown area to feed the underground system. Terminations of cables to overhead lines are made without the use of potheads.

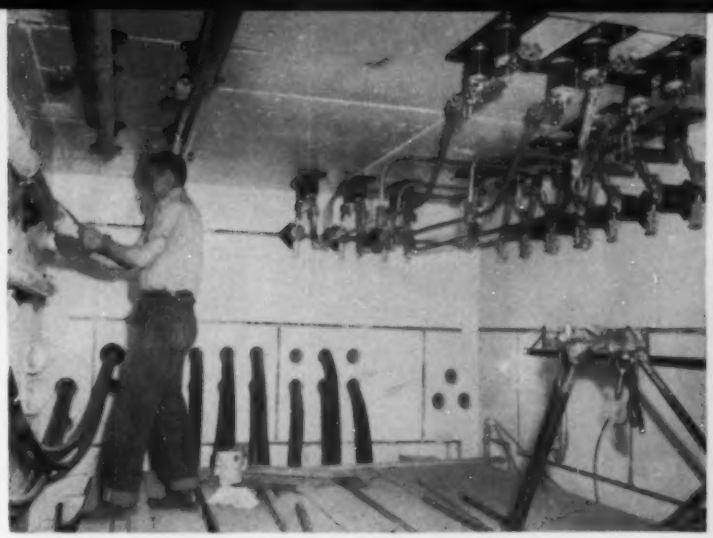
**ACCESS to vault is through the removable sections at one end of the vault**

Cables project out of risers for several feet and connect to the overhead system through a 15-kv oil switch and disconnect switches. Each terminal is protected by valve-type lightning arresters. Riser ends are filled with a plastic duct sealer to provide a weatherproof seal.

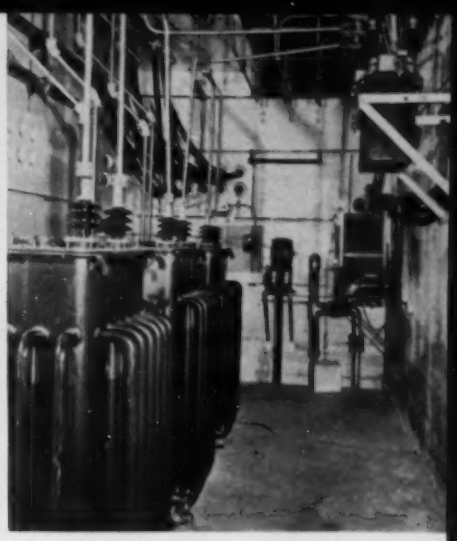
Cables run from overhead feed points to strategically located pull boxes or to copper buses in the sectionalizing vaults. For connecting aluminum cables to the ¾-in. IPS copper tubing bus, an eight-bolt, tin-plated, bronze clamp is used. The clamp is designed for expansion and contraction of the two dissimilar metals without developing a poor connection.

**CABLE TERMINAL consists of 15-kv oil switch, disconnects, 15-kv arresters**

**CONSTRUCTION TIME for a 30x14x10-ft vault was 18 days from the time digging began until the street was repaved. Up to date, five such vaults have been built**



**BUS RUNS for secondary (left) are 3-in. extra-heavy IPS copper. Primary buses fed by 250-MCM aluminum cables and the transformer leads are ¾-in. IPS copper**



**VAULT holds 500-kva transformers, 15-kv oil switch, disconnects and buses**

Clamping bolts are set up by torque wrench with a maximum of 150 in.-lb of torque applied. Connections are covered with tinned tape followed by splicing tape and covering tape. The entire connection is then coated with cable paint. This same technique is used at riser terminals to connect the aluminum cables to the ¾-in. IPS copper tubing leads of the oil switch.

**Copper Tubing Used For Bus Runs . . .** With one exception, the ¾-in. copper tubing is used for all primary bus runs, for primary leads to the transformers, and for load-side leads to the oil switch. Between the copper bus and the line-side terminals of the switch, 2/0 stranded copper cable is used. This cable terminates on the bus in a bronze U-bolt connector. Because of the short lengths involved, the stranded cable presented a more flexible method of making the connection with no loss of reliability.

The secondary bus consists of 3-in. extra-heavy IPS copper piping. Transformer secondary leads of 2-in. IPS copper tubing are attached through a six-bolt, split bronze clamp. Aluminum secondary cables are attached with similar tinned bronze clamps.

Vaults that measure 30x14x10 ft accommodate three 500-kva, 14.4-kv-120/208-v, OA conventional-type transformers, 15-kv oil switches with an interrupting rating of 1,250 amp, and primary and secondary bus runs. Steel channels embedded in vault walls provide for mounting of bus insulators, porcelain saddle-type cable clamps, and brackets for oil switches. Vaults are located in streets along the curb line because of the absence of alleys. To comply with Arizona highway loading requirements, roof structures are designed to withstand a 20-ton impact.

To meet this loading, 3½ ft of cover over the vault spreads the cone of impact over a wide area of the roof structure. This minimizes the size and quantity of reinforcing steel necessary. The roof consists of 14 in. of concrete in which are embedded 1-in. cross bars on 5-in. centers and ½-in. longitudinal bars on 5-in. centers. Cross bars are installed with a 20-in. overlap into the sides of the vault. All concrete was poured in place, and inside walls were painted white after the concrete had set.

**End of Roof is Removable . . .** To provide access to the vaults for the placing or removing of transformers and other equipment, one end of the roof consists of three removable sections which form an opening 10x4 ft. One section, 5 ft 9 in. long, has a manhole in the center for access by workman. Sections rest on two reinforced-steel concrete beams placed across the vault. Angle irons cast into section edges and on top of the beams facilitate easy removal of the sections. To remove sections it is necessary only to chip around their edges with an air-hammer, uncover lifting rings cast into them, attach a sling and lift.

Normal ventilation of the vaults will be by natural circulation. Vents at both ends consist of 3-ft ID concrete sewer pipe running from the vault bottom to grilled openings in the sidewalk. To provide forced circulation for summer operation, one vent is equipped with a thermostatically-controlled, 3,500-cfm fan which comes on when the vault temperature reaches 90 F. Sidewalk openings are large enough so that maximum air velocity is only 7 mph.

**Prevents Flooding of Vault . . .** With vent openings several inches above street level, surface water from most rainstorms will not overflow into the vaults. However, severe rainstorms of "cloudburst" proportions are experienced occasionally in Tucson. Thus, provision has been made to prevent flooding. Built into one end of the vault is a sump 2 ft wide and 3 ft deep to collect nominal amounts of water. As the water rises, a float valve in the sump will start a 250-gpm, 3-hp pump. Should the water level rise 2 ft above the vault floor, dampers in the vents will close automatically. The pump is designed to discharge into a storm sewer against a maximum possible head of 20 ft. A check valve in the discharge pipe prevents the sewer from backing up into vault.

Rainstorms normally occur during the summer when the ventilating fan would be operating. However, the cooling effect of rain on the street and water coming into the vault offset the lack of air cooling during the time involved. Experience has shown that transformer temperatures will not rise above desired operating levels.

12 Kv Switchgear (Second Floor)
12 Kv Terminals, Station Service Switchgear and Air Supply ( First Floor)
69-Kv PT
69-Kv Switchgear
30/40 Mva, 69/12 Kv,
3-Ph. Transformer

**SUBSTATION HAS DIFFERENT APPEARANCE THAN CONVENTIONAL OUTDOOR SUBSTATION BUT FITS SURROUNDINGS**

# New Substation Is Metal-Enclosed

## Duquesne Light's 69/12-kv unit for reinforcing downtown Pittsburgh supply uses 69-kv isolated-phase bus, and achieves compactness and local harmony

**EDWIN M. GUE,** Electrical Design Engineer, Duquesne Light Co, Pittsburgh, Pa.

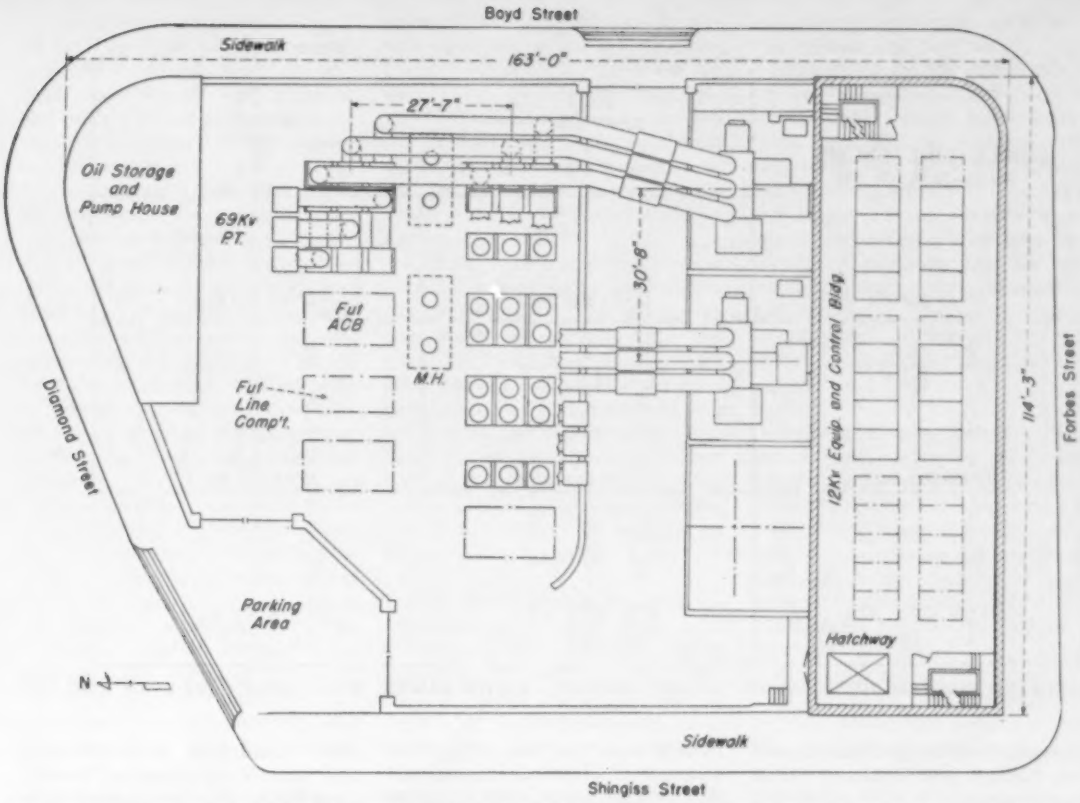
A metropolitan 69/12-kv, remotely controlled substation, under construction today to reinforce the power supply to downtown Pittsburgh, features compact design and metal-enclosed equipment. When completed, the substation will have seven 69-kv breakers, three 40-Mva transformers, and 30 12-kv breakers with associated equipment in less than 17,000 sq ft.

The new Duquesne Light Co substation's use of 69-kv isolated-phase bus for the high-tension connections will afford both safety and appearance harmonious with its surroundings. The bus is rated at 2,000 amp, and the air-blast circuit breakers have an interrupting rating of 3,500 Mva.

Ultimately a ring bus will be used for the 69-kv connections as the 69-kv lines will serve also as system ties between two major generating stations. Dual use of lines is highly desirable because the shortest distance between the generating stations lies through the downtown area. While the initial installation will not allow for closing the ring, it will provide for three incoming lines, two of which will be energized about a year before the third.

**SUBSTATION YARD,** as seen from switch-house roof, shows 69-kv metal-enclosed structure being assembled. Low roof at the upper left covers the oil house

**Supply Will Be 69-Kv Pipe Cable . . .** Near the substation 69-kv lines will be pipe-type cable although overhead construction will be utilized as far as practicable. Each incoming line will




**PLOT PLAN SHOWS HOW DESIGNERS FITTED OUTDOOR EQUIPMENT AND 3-STORY BUILDING INTO 17,000 SQ-FT SITE**

be provided with potential transformers, lightning arresters, and cable-grounding switches.

Transformers will be 30,000 kva, self-cooled, with a forced air rating of 40,000 kva. The low-tension side will have ±7½% load ratio control equipment, and the neutral of the star-connected low-voltage winding will be grounded through a 3-ohm resistor. Such grounding limits fault current to a value that can be handled by existing network unit grounding switches while restricting transient overvoltages to reasonable values. Two transformers will be installed initially although provisions are adequate for adding the third bank.

The 12-kv connections were dictated by the character of the load to be served. Ultimately there will be three separate network areas with six feeders each. Because of the importance of the load in these areas, the company felt that no single substation fault should result in the loss of more than one feeder to each of the three areas. This thinking resulted in the establishment of six bus sections with an ultimate of three feeders per section, each of which is fed by two transformers. The initial installation will consist of four sections with two feeders per section.

All circuit breakers are air-blast type with a rating of 14.4 kv, 1,200 amp, and 1,000 Mva. Each feeder will be equipped with line grounding switches and potential transformers for indicating the operation of protectors on the network transformers connected to feeders.

**Site Selection Difficult . . .** The company found it no small task to find a site for a substation in a highly congested metropolitan area. From the beginning it was apparent that conventional design would probably have to be abandoned. Many factors, besides substation cost and design, had to be considered. These included:

**1.** The load area.

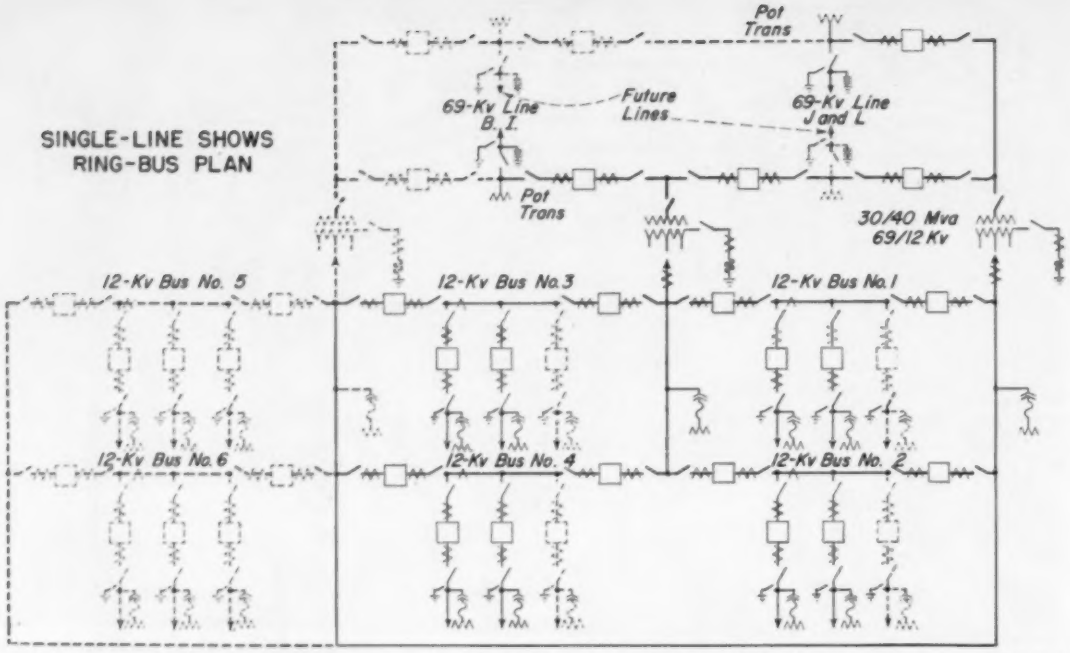
**2.** Route of the pipe-type cables and cost of extending them if the site did not fall on their natural route.

**3.** Availability of street routes for new 12-kv feeders and the cost of extending duct lines to the existing system.

Three possible sites, obtainable at reasonable cost, were small in area and unsuitable for conventional outdoor substation construction. But one of these was practically on the "natural" route of the 69-kv cables and provided adequate street space for 12-kv duct lines. Overall project economics favored this location provided construction upon it would not be too costly.

Unfortunately the site contained 17,000 sq ft and was adjacent to the route of a proposed elevated highway. It was also near an area selected for redevelopment. These factors indicated the necessity of designing an enclosed substation with safety and appearance as key attributes.

Enclosing low-voltage equipment presented no problem, but housing the 69-kv bus and switching equipment without sacrificing insulation level offered a challenge. An exhaustive study




**SINGLE-LINE DIAGRAM GUIDES DESIGN. FUTURE ADDITIONS, SHOWN DASHED, WILL COMPLETE THE 69-KV RING BUS**

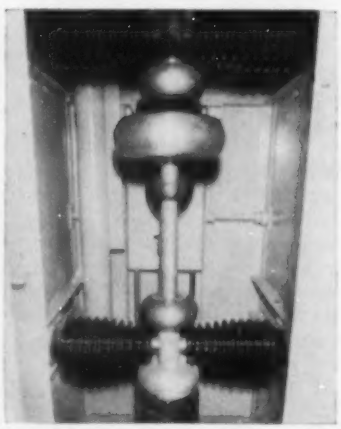
into possible lightning surges indicated that standard 69-kv insulation should be maintained.

Initial studies contemplated a large building enclosing all equipment except the main transformers. This scheme, however, was abandoned because of the cost and lack of space. Preliminary layouts showed that the site could accommodate an isolated-phase, metal-enclosed bus installation, such as had been used at 69-kv where lightning exposure was not a problem.

Bus diameter, however, could not exceed 43 in. Study indicated that a 350-kv impulse level, with appropriate 60-cps values, probably could be obtained within this dimension. Actually the bus was developed with an inside diameter of 38 in. and a conductor diameter of 4 in. Because of the location and the necessity of close circuit spacing, it was decided to use compressed-air circuit breakers for both 69 and 12-kv switching.

**Substation Can Be Expanded . . .** The plot plan shows initial and final development of the compact substation. A three-story masonry building on the Forbes Street side contains all 12-kv switching and auxiliary equipment. The top floor houses relaying and control equipment, along with the building heating and ventilating system. Directly below this floor is the 12-kv breaker room. Initial installations provide for four sections, but ultimately there will be six.

The ground floor houses outgoing line compartments, bank potential transformers, station service switchgear, and the centralized air supply system, and segregated-phase transformer leads run along its ceiling. The 12-kv feeders leave the station through cable vaults in the basement. Adjacent to the rear of the building and separated by masonry walls are the main transformers. Special bushing and radiator arrangements provide space for the three transformers, loading platform, and passageways. Neutral grounding resistors are in the transformer wells.



**STATIC SHIELDS surround contact fingers on 69-kv disconnecting switches**

**Switchyard and Breakers . . .** The access roadway separates the 69-kv switchyard from the transformers. Isolated-phase, air-blast breakers are arranged in ring-bus conformation with space between the rows for 69-kv cable manholes which contain trifurcating joints with laterals extending to the incoming line compartments. These isolated-phase enclosures provide space for potheads, lightning arresters, and line-isolating and grounding switches.

Condenser-type bushings seal line compartments and circuit breakers from the main bus runs. Carbon-dioxide fire-protection equipment is provided in the line compartments because of the oil-filled potheads. Transformer-isolating switches are over the driveway. Due to their inaccessibility, a special built-in, "fail-safe," lighting device is placed so that the position of the switches can be observed from ground level.

Considerable development was required to obtain suitable impulse level in the small enclosure containing the 69-kv disconnecting switch. Static

shields surround the contact fingers on both the fixed and moving contacts. All disconnects are of the telescoping type with the blade retracting into either a section of the bus or the condenser bushing in the circuit-breaker housing.

Incoming line Askarel-filled potential transformers are in isolated-phase compartments near the top of the bus structures. As they are protected by line circuit breakers, no fuses are provided. All switches are operated from the ground or from grating platforms surrounding the upper parts of the structures. Supporting steel was kept to a minimum by using the equipment housing as supports. Excepting those on the circuit breakers, all housings are aluminum.

Phase spacing of the 69-kv bus is approximately 5 ft. Minimum circuit breaker spacing is 14 ft 9 in., and the highest equipment is approximately 30 ft above grade. The oil storage and pumping plant for the 69-kv cable is in a separate building on the northern corner of the plot. This building is of masonry construction and forms part of the enclosing wall around the entire plot. Room is provided for a small off-street parking area on the Diamond Street side.

**Air Supply System Centralized . . .** Cost and space economy favored a centralized air supply for the entire substation. The system not only supplies air for operation of the breakers but also supplies bleeding air constantly to the 69-kv breakers to prevent condensation on critical parts. Major components of the system are three 15-hp, 24-cfm free air, 1,000-psi, water-cooled compressors and two storage units, each with a volume of 18 cu ft and a storage pressure of 950 lb. Reducing valves supply air at 260 psi for the 69-kv and at 150 psi for the 12-kv breakers.

The air system is valved so that normally half of the circuit breakers at each voltage will be supplied from one compressor-storage unit. The other unit will serve the remaining switchgear. The third compressor is so arranged that it may be used with either of the two storage systems. Program control will equalize operation between the three compressors. The system installed is the ultimate for the station and will not be expanded as more breakers are added.

**Station Service Power Supply . . .** Continuous power supply to the cable oil pumping plant and the air supply system necessitated a very reliable auxiliary power supply system. As there is no backfeed from the 12-kv system from other sources, the company concluded that the station service transformers should be connected to the main transformer leads.

As adequate space was not available for an independent installation, 225-kva, 3-phase units were located in separate oil-filled compartments attached to the main transformer cases. All connections are internal, and the small transformer is protected by suitable resistors and fuse links.

Exposure to the low-voltage windings of the auxiliary transformers is minimized by locating an automatic circuit breaker in an air-filled compartment directly below the auxiliary transformer. Each main transformer is equipped with an auxiliary transformer, and station service buses are provided in duplicate. Like the centralized air supply system, the auxiliary load is divided between the station service buses. Either of the two sources is adequate for the entire station load.

**Operated by Remote Control . . .** The station, being unattended, will be operated by remote control from the load dispatcher's office. This equipment is conventional except for such special features as a selection bus permitting closing of a chosen number of 12-kv breakers simultaneously. This device is needed to pick up the load of a secondary network.

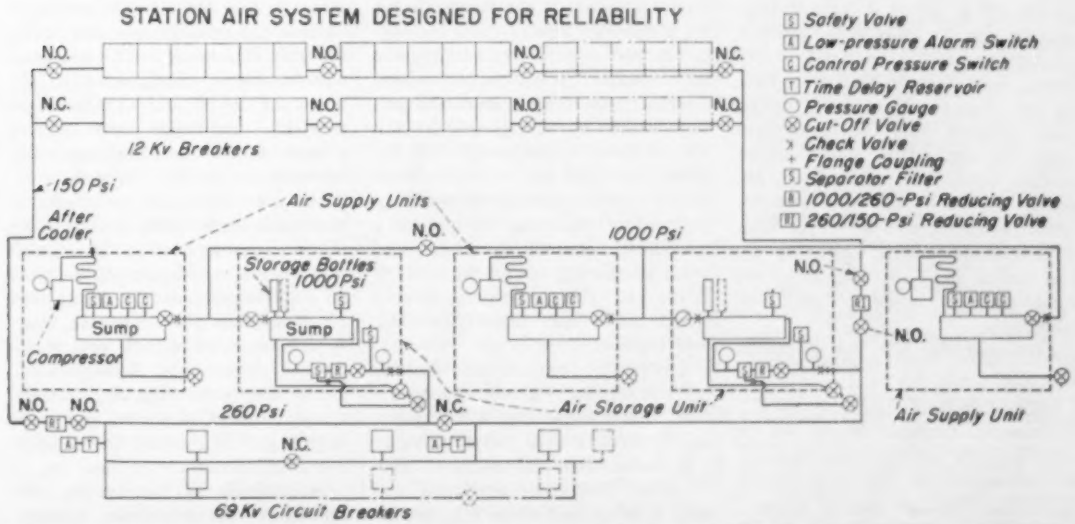
Relaying is applied as follows:

**1.** The 12-kv lines are protected by phase and ground non-directional, short-time overcurrent relays. Back-up protection is provided by phase and ground bus overload relays.

**2.** The 12-kv buses are protected by variable percentage ratio differential phase relays. Secondary protection is provided by the bus overload relays.

**3.** The 69/12-kv transformers are

(*Continued on page* 200)




**SCHEMATIC DIAGRAM ILLUSTRATES AIR SUPPLY SYSTEM FOR OPERATING BREAKERS AND SUPPLYING BLEEDING AIR**

MECHANICAL EQUIPMENT CUTS CONSTRUCTION, MAINTENANCE COSTS AND SPEEDS RESTORATION ALONG STREETS

# Why Overhead Distribution Lines?

## Best engineering solution—low cost, convenience, and maintenance—puts them there on public streets where they have established right to remain

G. E. DEAN,* Distribution Engineer, Public Service Electric & Gas Co, Newark, N. J.

Putting overhead distribution lines on the public streets is the best engineering solution today to the problem of moving electric energy to every home, store, factory, and street light in the territory served by a utility. This exigency puts the distribution lines on the public streets where similar needs put milk, coal, oil, refuse collection, and store delivery trucks; mailmen; and newspaper boys. Public streets—public ways they are still called in New England—were established to accommodate such traffic.

Obviously the first use of public streets was surface use by pedestrians and horse-drawn vehicles. Other uses followed: sewers and water supply mains, illuminating gas mains, and such wire users as the telegraph and the telephone. Finally came the electric supply utilities. Water supply had to be subsurface to prevent winter freezing. Sewers, both storm and sanitary, had to be underground so that the collection system could drain the streets and buildings. Gas lines were buried to obtain a relatively even temperature of the mains to provide a reasonably constant pressure and avoid condensing out of the light oil in the gas. These pipe-using services found subsurface construction their best engineering solution.

Electricity changed this pattern, being unaffected by gravity or temperature. The communication and power supply services were free to consider both subsurface and overhead construction. Both were developed, and each is being used where it is the better engineering solution.

Underground distribution facilities have been installed where the amount of overhead construction would have caused excessive congestion. Application of this policy results in the use of complete underground distribution facilities in downtown business areas and the use of underground for certain trunk line facilities near the larger substations and under streets carrying a large number of circuits. Local distribution may remain overhead.

Various factors have contributed to the establishment of this policy. There is an economic limit to the number of wires that may be carried overhead on a single pole line. There is also a practical limit. Poles with too many wires make construction and maintenance difficult and dangerous, increase the probability of accidental contact between wires, and expose too large a part of the electrical plant to any single hazard.

Accordingly, it has become customary to use subsurface construction for areas of very heavy electrical

* Based on a paper by the author presented before the "Street Tree and Utility Conference", Cleveland, March 3-4. It was one of several papers covering street trees, overhead lines, and street lighting. Proceedings of the conference will be available from the three sponsoring organizations: Edison Electric Institute, Illuminating Engineering Society, and the National Shade Tree Conference.

load, such as downtown city areas, where it is the better engineering solution. These underground areas are now being expanded where urban development and concomitant load increase make underground the logical construction.

The question is frequently asked: "Why are not all these overhead lines placed underground?"

Public Service Electric & Gas Co has approximately 9,400 miles of overhead wood-pole lines in its territory. The type of underground system which can be installed at minimum cost employs simple radial circuits and locates conduits under sidewalks or outside of paved roadway areas where repaving expense is not incurred. In 1953 the estimated cost of such a system replacing existing overhead was $1.1 billion. Estimated additional capital expenditures of $15 million each year would be required to reinforce and expand the entirely underground plant to serve new customers and to carry additional loads.

Perhaps the expense of installing an all-underground plant can be better visualized in terms of specific units of the underground plant. Recently it was proposed to place underground the existing overhead plant on a Camden, N. J., street. An office estimate placed the cost at $82 per street ft.

A recent program for reinforcing the underground supply network in Newark brought out that a manhole with transformer, network protector, and cable connections costs about $16,000. This is what a five-room house in a modern real estate development would cost.

**Underground Was Never Cheap . . .**

Even were it possible to attract new capital for substituting underground for overhead facilities and to obtain and train the required manpower, the costs of the new capital, together with the other increased expenses of such a plant, would have to be covered by boosts in electric rates substantially above present amounts.

It is significant that as early as 1911, when a Public Service estimate put the cost of placing 2,225 miles of circuits underground at $35,625,590, it wasn't done. The all-underground system was not the best engineering solution then, and it is not the best engineering solution now. And it is doubtful that the average customer today would choose an all-underground system, knowing the substantial rate increases it would entail.

**DISTRIBUTION LINES on private property involve a utility in trouble with property owners who plant their premises and then refuse permission to trim**

**General Considerations . . .** The foregoing arguments are reinforced by common practice throughout the world of favoring overhead, particularly wood-pole, lines as an important part of electric distribution. And normally these wood-pole lines are installed on the public streets. With the practical aspects of putting the distribution system underground out of the way, there still remains the question: "Why are such lines on public streets instead of on private rights-of-way?" In answering this, perhaps no less biased opinion could be cited than that of the regulatory authority.

**What House Committee Was Told . . .**

Austin L. Roberts, Jr., general solicitor for the National Association of Railroad and Utilities Commissioners, in testimony before the subcommittee on roads of the House Committee on Public Works on July 8, 1953, stated:

"Occupancy of highway rights-of-way by utilities benefits the public.

"Utilities have been permitted and encouraged by legislative enactments and municipal ordinances over the years to make use of public highways for the location of their plant and facilities in order to stimulate development of utility services and to make these services available to the greatest number of people at the lowest possible costs.

"Any other policy requiring acquisition of private rights-of-way for utility facilities would have increased the cost of utility services (without any corresponding decrease in the cost of road construction) and thereby retarded social and industrial development and depressed the standard of living. Highways are the arteries of modern civilization; they do not serve exclusively to accommodate vehicular travel but they also serve as a means for providing other services which promote the public welfare. In many areas it would be impossible to provide essential utility services to the public without use of public thoroughfares.

"It has long been recognized by the courts that utilities do not occupy public rights-of-way by sufferance; but, on the contrary, when they construct facilities on public right-of-way under legislative sanction, their right to continue to use the public highway becomes a fixed and vested property right (eg Russel vs Sebastian

DISTRIBUTION PLANT ON REAR PROPERTY LINES MUST BE BUILT AND MAINTAINED BY MANPOWER ALONE

233. U.S. 195). In short, utilities are not trespassers or squatters on the highways—their occupancy of the public rights-of-way is a proper use of the highway, is not a burden on the highway, and serves the public interest."

**Economy Puts Them There . . .** This article considers curb-line vs private-property poles, not street vs alley poles. An alley is just a lower grade public way, often requiring lighting, but still available to the public including the power company. Public Service, upon whose experience this article is based, does not distinguish between streets and alleys.

The public highway, street, or public way is the proper place for poles as determined by economy, that important factor in the best engineering solution as well as in the establishment and preservation of the low rates now prevailing in the power industry. Economy places pole lines on public streets because construction costs there are lower. This situation is due to two main factors, one general and the other specific.

**Street Lighting Requires Poles . . .** It is axiomatic today that the public demands street lighting. When the power pole line is on private property, usually in the rear of the property, two lines of poles are needed, no matter what the street lighting provisions or street layout may be. This duplication of pole plant obtains even when the lighting is municipally owned, and the public must pay for it through higher electric rates or increased taxes.

The specific factor pertains to construction methods. Pole-line construction is today almost completely mechanized, such mechanization obviating run-away unit costs. Holes dug and poles set by hand are very expensive, although at certain seasons such work cannot be wholly eliminated. Four-wheel-drive earth auger trucks and heavy line trucks cannot be used year round on backyard locations. In many new real estate developments streets are the only hard ground in the spring, although electric service must be available on short notice as householders move in.

**Pole Lines on Streets Cut Costs . . .** Economy places pole lines on public streets because maintenance costs there are lower. Such maintenance is twofold: maintenance of the pole line itself and tree trimming to keep the pole line clear of tree limbs which endanger service. Again hand labor, in contrast with mechanical equipment, is an element of the problem.

When lines are at the rear of a residential property, poles must be replaced by hand. The new pole is brought in from the street and the old one brought out by manpower and a special light-weight dolly. Wire work is slow and expensive, the usual fences and plantings making access difficult. During tree trimming, mechanized equipment must be left in the street while work proceeds by hand on a backyard pole, and all trimmings are carried by hand to the truck or chipper for disposal. Building and maintaining a pole line 150 ft or further from the nearest street is analogous to building a factory without a driveway. Factory products must be carried to the street and lifted by hand into a truck, a procedure that is slow, laborious, and expensive.

**Reliability Is Factor . . .** The modern factory, store, and residence are completely dependent upon electric service. Such service must be continuous which means that distribution lines must remain intact. Every power utility is

continually engaged in efforts to reduce those interruptions and speed up repair and restoration.

Tree interference contributes largely to distribution line outage in normal weather, including normal wind and rain storms. In disaster-type storms, hurricanes and severe ice storms, falling trees and limbs cause approximately 90% of all damage to electric lines. Modern communities want trees both along public ways and on private property.

Generally, trees along public ways are the responsibility of shade-tree commissions or tree wardens and are better selected and maintained, and more promptly removed when diseased than those on private property. A tree properly planted and maintained gives less interference than one of haphazard selection and zero maintenance. As trees in the rear of private property are usually uncontrolled, electric lines should be so located as to avoid them.

**Rear-Lot Lines Hard to Service . . .** When a distribution-line outage occurs, the fault must be located and repairs begun quickly. Following such an interruption, a fast inspection patrol can be made along a curb-line pole plant. With another person driving, the line inspector can move rapidly by car along the line.

He must leave the vehicle and travel by foot, however, to inspect lines built at the rear of private property. With the present prevalance of fences and extensive shrubbery plantings, he is hindered in moving by foot along the pole line and compelled to return to the street to enter the adjoining property. After dark, he must carry out his inspection with small, portable lamps instead of the powerful, vehicle-mounted and vehicle-battery energized lights used on street lines.

Following fault location, line repairs must be made. The factors boosting maintenance cost at backyard pole lines show up in repairs at such locations. Carrying materials by hand and night work unilluminated by vehicle lights prolong the service interruption, especially during disaster-type storms.

**Streets Are Cleared After Storms . . .** After such storms blocked streets are promptly cleared of fallen trees and opened up to traffic by a public agency. Access is afforded to the work area of line damage for utility line crews,

**SERVICE RESTORATION is slow and costly at sites such as this one where mechanical equipment cannot be used and the linemen are compelled to improvise**

and mechanized equipment can be moved in and utilized. On the other hand, backyard tree tangles may not be cleared up for weeks. Such tangles slow repairs and service restoration, and slow repairs mean a poorer service record.

**Public Relations . . .** Careful, cooperative, and consistent tree trimming is a good electrical distribution practice. Shade tree commissions and tree wardens are usually better educated, more experienced, and more consistent than property owners with regard to tree care and the need for expert tree trimming for electric line clearance. Backyard electric lines consume the time of the consent man, and, when he is hurried, "friction" may arise between him and the customer resulting in the latter's refusal to permit trimming. A careless trimmer may also cause a disgruntled customer.

Access to lines on private property is difficult. Men, materials, and equipment for line construction, inspection, and maintenance must move across private property. Even with great care, some damage to lawns, gardens, or shrubbery is inevitable; and even though the resulting damage claims are handled promptly and thoughtfully, there remains the memory of the damage.

Utility pole lines, though carefully engineered and expertly constructed for utility purposes, are subject to unauthorized attachments. When the line is on private property, it is difficult for the utility to control unauthorized attachments, such as radio antennas, clothes lines, fences, trellises, and basketball baskets. Such attachments offer hazards to the public and the utility linemen. Insistence upon their removal may lead to misunderstandings.

**Customers Can't Be Kept Happy . . .** Utility pole lines on private property may also be a basis for misunderstandings arising from landscaping. With the modern trend toward outdoor living, the idea of "planting out" or hiding utilitarian objects like poles and wires is spreading. This trend often takes the form of shrubbery or trees planted immediately around a pole, or the training of climbing vines upon the pole. Besides being a hazard to lines and linemen, such plantings may lead to damage claims after line work and to "friction" with the property owner.

**EARTH DAM built across ravine at narrow point forms reservoir to hold water for station requirements. Dam is 75 ft high and dikes extended a total length of 2,500 ft. Cooling towers are also used to help solve water problem**

# Made-Lake Beats Cooling Problem

## Ravine dammed to form 120-acre reservoir. Water is pumped into it from river during high rain-fall season to supply power plant's year-round needs

**F. V. SMITH**, Partner, Sargent & Lundy, Inc, Chicago, Ill.

**R. L. MARTIN**, Manager, Power Plant Design, Illinois Power Co, Decatur, Ill.

An artificial lake has solved the water supply problems of the new Vermilion steam power station of Illinois Power Co. The 120-acre lake will provide an adequate supply of water for cooling, boiler feed make-up, and other station requirements.

Illinois Power, which ten years ago bought practically all of its power requirements, has 621,300 kw of capacity in four major and eight minor stations. Vermilion Station will ultimately add 300,000 kw to this total. The first unit, 75,000 kw, has just gone on the line. A second unit of 100,000 kw is scheduled for next year.

When the company decided to build the station, now called Vermilion, it was decided that the proper location was somewhere in the eastern part of the system. Extensive studies were made of a number of sites. It was found, however, that the only available source of water was the middle fork of the Vermilion River which has a very low minimum flow.

After analyzing the situation, including the possibility of moving east across the Indiana border to a site on the Wabash River, the company decided on the present site, ten miles northwest of Danville.

The water problem here could be solved in one of two ways:

**1.** A dam could be built across the river with provision for controlling flow.

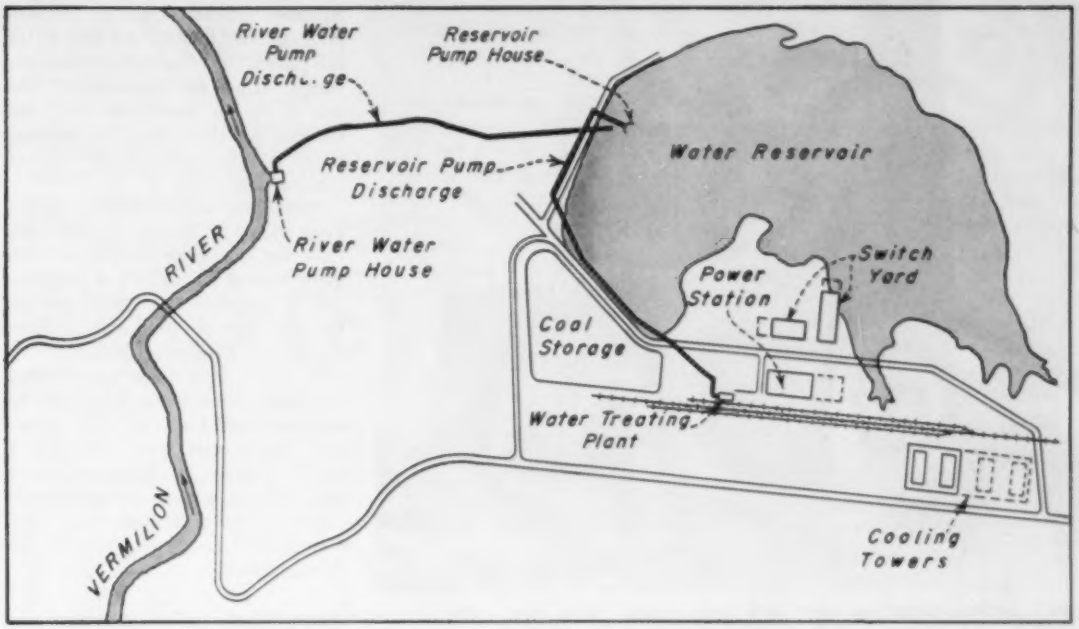
**2.** An artificial lake could be constructed.

The first solution was rejected because a dam would be costly to construct and would bring with it an extensive maintenance and control problem. All the land which would be flooded also would have to be acquired.

The many deep ravines in the area made the artificial lake the better solution. One of these could be dammed at relatively little cost. It could be filled with water pumped from the river. Reinforced by cooling towers, the lake would hold enough water to carry the station through the longest dry spell on record. Evaporation, seepage, and siltage would not have any serious effect because allowances were made for them.

In order to provide storage the water must be pumped into the reservoir during periods of high stream flow. A minimum downstream flow from the river pumps will be maintained at all times to sustain fish life. The reservoir itself has about one square mile of drainage area which will supply some of the necessary water.

To form the reservoir an earth dam was built across the ravine where its banks come together and the ravine is only about 400 ft wide. The dam will be approximately 75 ft high at the deepest point. Dikes extend a total length of 2,500 ft. Suitable compacted fill material to form the dam was found in the neighborhood. Inspection wells, from which ground water levels can be determined, were in-




**ARTIFICAL LAKE permits ultimate station capacity of 300 Mw. Reservoir holds enough water to carry the station through the longest dry spell on record, with generous allowance for evaporation, seepage, and siltage losses**

stalled in the dam. The reservoir, when filled, will cover 120 acres.

The power station, substation, cooling tower, and coal handling plant are located on a plateau approximately 130 ft above river level. Maximum level of the reservoir is approximately 110 ft above river level and 20 ft below power station grade. This location was chosen as the most suitable in view of the topography and railroad connections.

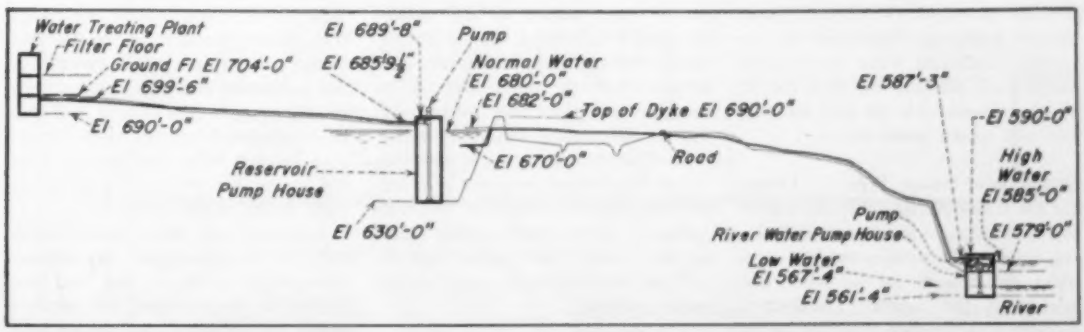
The pumping station at the river houses two 4,500-gpm pumps. The reservoir has a capacity of 700 million gal and is designed to handle full ultimate station capacity at 60% load factor for 120 days without inflow.

Pump controls are at the pump house. However, pumps are equipped with safety shutoffs to stop the pump in event of loss of discharge flow. One pump will be operated whenever river flow is 10 cfs above minimum flow and two when flow is 20 cfs above minimum.

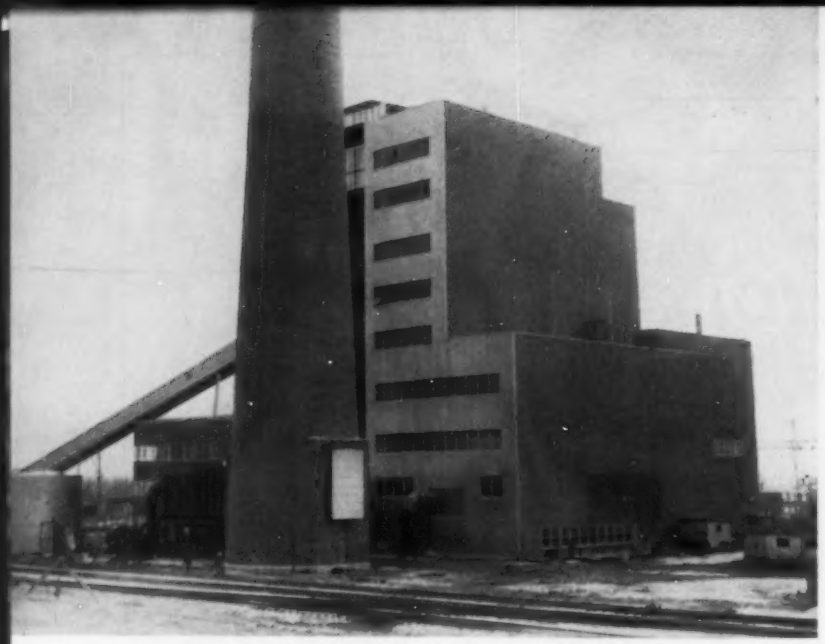
A pumping station at the reservoir will deliver water to a treating plant where all water for cooling towers and station use, except for ash pit seal, is conditioned. This pumping station has two 2,500-gpm pumps, each capable of supplying make-up for two units.

Water is treated by the cold lime-soda ash method in a concrete precipitator basin where it overflows into a clear well. This water is then pumped through filters to a make-up line. From this line, part of the water goes directly to the circulating water system as make-up. Part is pumped into the service water system for cooling bearings and for similar purposes and then returned to the circulating water system. Part is passed to a demineralizing plant for boiler feed water make-up. A 75,000-gal demineralizing water storage tank is provided for use with boiler Units 1 and 2.

Unit 1 cooling tower is of the cross-flow induced-draft type. It is designed to cool 53,000 gpm from




**PUMPING STATION at the river houses two, 4,500-gpm pumps. River flow sufficient to sustain fish life will be maintained at all times. Maximum level of the reservoir will be 110 ft and 20 ft below the grade of the power station**



**UNIT ARRANGEMENT** is used with semi-outdoor boiler and indoor turbo-generator. Turbine room has brick walls, boiler room has aluminum walls

101.5F to 86F with a wet bulb temperature of 76F. There are nine cells. Each has a 22-ft diameter fan, driven by a 50-hp, two-speed reversible motor. Fans are controlled from the central control room. Water is circulated by two 26,000-gpm horizontal, outdoor-type circulating pumps from the condenser to the cooling tower through 54-in. steel supply and return lines.

Sulphuric acid will be added to the circulating pump suction to maintain a pH of 6.5 to 7.5 to prevent precipitation of calcium carbonate in the circulating water system. Liquid chlorine will be fed intermittently to the circulating water system just ahead of the pump suction to prevent algae growth in the condenser and tower.

Ash sluicing water is taken from the cooling water system and acts as a major blowdown or deconcentrator. Should additional blowdown be required, circulating water can be used for the ash pit seal and then run to waste. Normal ash pit seal water is returned to the reservoir.

**Station Is of Indoor Type . . .** Except for the semi-outdoor boiler the station is of the indoor type. The main building houses the turbo-generator, provides semi-housing for the boiler, and houses all the necessary auxiliaries, coal bunkers, elevator, traveling bridge crane, control room, machine shop, laboratory, offices, and storage rooms. It will be supported on a reinforced concrete slab. Walls in the office building and turbine room will be of brick. Walls of the boiler room will be insulated aluminum siding. The temporary wall will be fluted steel siding.

The turbine is a 75,000-kw, single spindle, 3,600-rpm, tandem compound, double flow, reheat unit designed for steam conditions of 1,450 psig, 1000F/1000F operating at 1.5-in. hg back pressure. Generator capability is 90,875 kva at 13,800 v with 95F cooling water when operating at 30 psig hydrogen pressure. Exciter is direct connected. The turbine will normally be operated from the control room. However, there is a start-up panel adjacent to the turbine.

A 55,000-sq ft surface condenser has its inlet welded to the turbine exhaust. Two vertical hotwell pumps, each of full capacity, will remove condensate from the condenser. A removable steel panel in the south wall will permit pulling condenser tubes.

Feed water heating cycle will consist of five heaters, two low pressure, one open direct contact, and two high pressure. Two motor-driven full-capacity boiler feed pumps will be equipped with hydraulic couplings for speed control.

**Steam Generator Will Be Semi-Outdoor . . .** The steam generator will be rated 525,000 lb per hr at 1,450 psig, 1,000F/1,000F and will be of the radiant-type controlled-circulation design. It will be semi-outdoor. The rear of the air heater, the roof, and the east side above the office building room will be the outdoor type of construction.

Pulverized central Illinois bituminous coal will be the primary fuel. However, the boiler is equipped with high-pressure oil burners of sufficient size to generate 250,000 lb per hr. Provision has also been made to burn gas should it become available.

To carry light loads satisfactorily for longer periods, the boiler will be equipped with four coal mills rather than the normal three mills for a boiler of this size. Minimum steam load with all burners in operation is 150,000 lb per hr without oil stabilization and 50,000 lb per hr with oil stabilization.

**Ashes Will Be Sluiced to Ravine . . .** Coal will be delivered in railroad cars and unloaded into a track hopper. A car shakeout will speed up the unloading operation. Four oil-fired thawing pits will simplify the handling of frozen coal. Coal will be carried from the track hopper by a belt conveyor to the breaker from which it can be taken directly to the station bunker or to the stocking-out bin.

A weightometer on the conveyor belt will weigh the coal from the track to the hopper. There will be no coal scales at the bunker outlets.

Ash and fly ash collected in the stack base, dust collector, and air heater hoppers will be hydraulically sluiced to a natural ravine north of the station.

**Units Controlled from One Point . . .** An air-conditioned central control room between Boiler 1 and future Boiler 2 will house cubicle type panels from which operation of the first two boilers and turbines will be controlled. All generators and high voltage feeders, future as well as present, will also be controlled from this room. However another boiler and turbine control room will be constructed when Units 3 and 4 are installed.

Automatic area load control, which includes telemetering of all essential information to the system load dispatcher by leased wire, will provide means for adjusting total system load as well as division of the load between units to demand of the system.

**Ring Buses Are Features . . .** Two ring buses, one 69 kv and one 138 kv, are features of the electrical system. The 138 kv ring will not be closed until the second unit is installed.

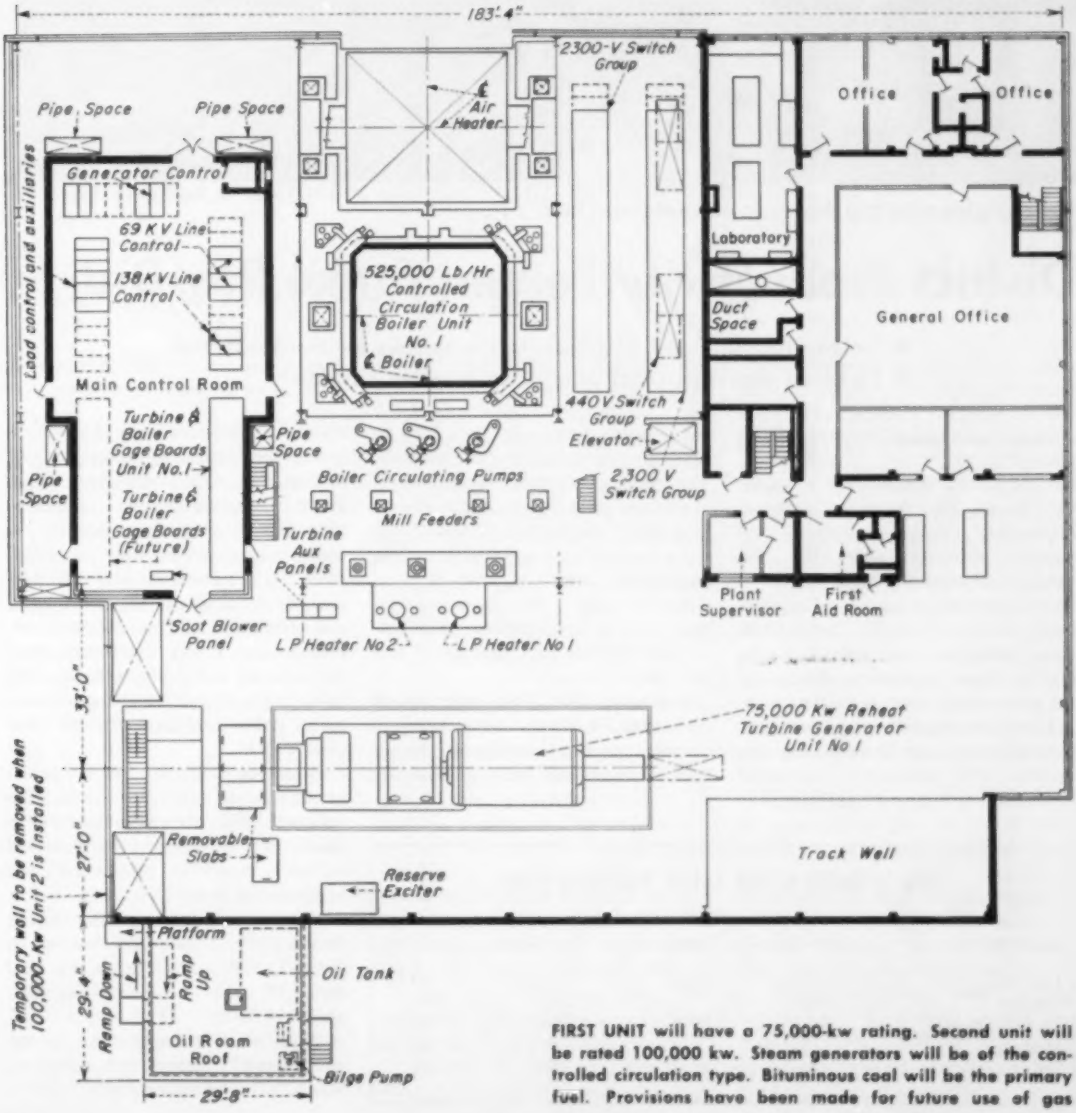
Power will be delivered from the generator through a 4,500-amp isolated phase bus to a 65,000/86,667-kva, 3-phase forced air-cooled transformer located outside the turbine room wall. Tapped off the generator bus, also through isolated phase bus and a magnetizing current interrupting disconnecting switch, is a 6,000/7,500-kva, 3-phase transformer supplying auxiliary power to the unit turbine and boiler. Generator neutral is grounded through a distribution transformer with secondary resistor.

Generator transformer is connected to the 69-kv ring bus in the switchyard. From this bus three feeders extend to the 69-kv transmission system and one to a 65,000/86,667-kva autotransformer stepping up to a 138-kv ring bus. Two feeders tie into the 138-kv system. Buses are of rigid construction supported from the ground on pedestal insulators. For station auxiliaries a 2,300-v grounded neutral system will supply all motors 100 hp and larger. Smaller motors will be served by a 440-v system.

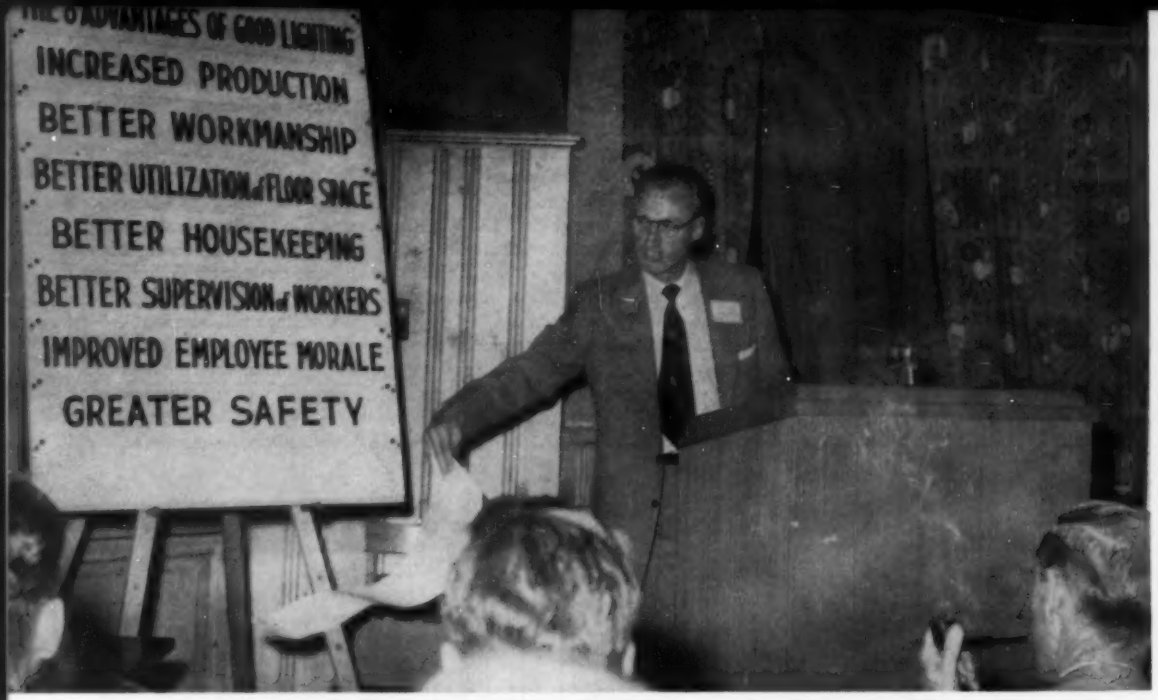
Normally, all auxiliary power will be served from the unit auxiliary transformer. In event of failure of that supply the buses will be automatically transferred to the reserve source of power.

Two 320-amp-hr, 250-v batteries are installed. One is for breaker operation, and one is for emergency lighting, valve motors, and emergency seal and turbine-bearing oil-pump motors.

Generator voltage will be controlled by a rotating amplifier type voltage regulator. A motor-driven reserve exciter, equipped with its own regulator, will serve as an emergency excitation source for the machine.




**FIRST UNIT will have a 75,000-kw rating. Second unit will be rated 100,000 kw. Steam generators will be of the controlled circulation type. Bituminous coal will be the primary fuel. Provisions have been made for future use of gas**




Careful planning and dramatic presentations help . . .

# District Productivity Forums Strike Pay Dirt

- Union Electric Co of Missouri puts emphasis on mechanization
- Picks up new industrial load from happier customers

Small industrial plant managements throughout the service area of Union Electric Co of Missouri are being invited to get "New Ideas for Increased Production" through a series of local meetings patterned after GE's National Productivity Forum.

The meetings are held at locations convenient to the group that attends. Local industrial sales personnel, who contact those customers throughout the year, handle most of the details.

Carefully planned programs spotlight different ways of increasing production with electricity. Industrial management people are told how to capitalize upon automatic processes. The movie, "Motors in Industry," dramatizes the easy, step-by-step program of mechanization and changing a manual to an automatic process. Participants are told how different types of electric heat can be used effectively to raise profits. The role of good lighting as a production tool is covered carefully.

Following the first meeting in November, a dozen installations of electric equipment developed. Industrial managements were surprised at many opportunities they had overlooked for increasing production and cutting costs with electricity. Union Electric's industrial sales representatives now are in greater demand, because managements want to know more details about making the best use of electricity to improve output and efficiency. Plant engineers reported that, before the forum, they had planned to install gas heat. But, having been shown the virtues of electricity, they subsequently installed electric heat.

In one case, a plant superintendent of a rolling mill, after seeing the program, told his plant foremen to check each operation in the plant and submit plans for improving and mechanizing them.

Some results of the first District Productivity Forum are shown in Table 1. The second forum was held Feb. 17, and the third was held April 14.

Attendance at the first two forums ran about 175 persons each. Of these, about 160 were customers.

**Table I—Results of First District Productivity Forum**

| Application | Now Installed | New Proposals | Estimated New Load | Total |
|---|---|---|---|---|
| Lighting | 14 kw | 11 | 170 kw | 184 kw |
| Heating | 18 | 5 | 151 | 169 |
| Air Conditioning | .. | 3 | 28 | 28 |
| Motors | 3 | 1 | 75 | 78 |
| Total | 35 | | 424 | 459 |

## Utility-Sponsored Research Bought This Progress in . . .

### Power Generation:

**Operation of generating units as large as 150 Mw, with sizes up to 300 Mw being built.**

**Steam pressures of 2,400 psi, with plants now projected for pressures up to 5,000 psi.**

**Steam temperatures ranging up to 1,200F.**

**Hydrogen cooling of generators and inner winding cooling.**

### Transmission:

**The introduction of voltages as high are 345 kv in this country and 400 kv abroad.**

**Circuit breakers of 25 million-kva interrupting capacity.**

**Developments in relaying, lightning protection, automatic control of frequency and voltage.**

### Distribution:

**Great improvement in materials of construction and equipment, giving greater reliability and less maintenance.**

**Higher distribution voltages.**

**Great improvements in insulating materials for wires, cables, and other equipment.**

This partial list of advances in technology answers question . . .

# Have Utilities Neglected Research?

**HOWARD P. SEELYE,** Manager of Engineering, Detroit Edison Co, Detroit, Mich.

The utility industry can well be proud of its record in research as evidenced by the results accomplished in growth, service, and economy. There is still much to be done. Utilities acting individually and as groups could profitably take an increasing and more definitely organized part in research. The research organization within the Edison Electric Institute is already set up to do this, if it can be expanded and strengthened along the lines which have been planned and which it has been following.

During the past year or two criticism has been directed at the industry for lack of awareness of the need for research and of sufficient emphasis on it. Certainly, if this criticism is sound, it should be carefully heeded as the industry can not afford to fall behind in this respect.

**What Is Research . . .** Research, as we shall consider it, includes rather broadly any organized investigation of new and untried materials, equipment, or methods, in engineering and also in other fields. It excludes any mere testing or trial of devices or operations already developed. Research by manufacturers, colleges, independent laboratories, and government agencies must be included as well as that done or fostered by the power companies themselves. Included also should be the very great amount of work of this character which has been and is being done by committees of EEI, AEIC, professional societies, and other organizations.

**Results Speak . . .** The question of whether or not the electric power industry has devoted enough attention and money to research is one which cannot have a positive answer. It must be largely a matter of personal opinion based on the results which have been accomplished. No compiled figures are available as to the amount of research dollars which has been and is being spent, and such figures would be of comparatively little significance if they were available. Dollars spent are in no way a measure of the useful results produced. Similarly, future research programs should be based on the necessity and advantage of the probable accomplishments, not on some number of millions of dollars or some percentage of gross income.

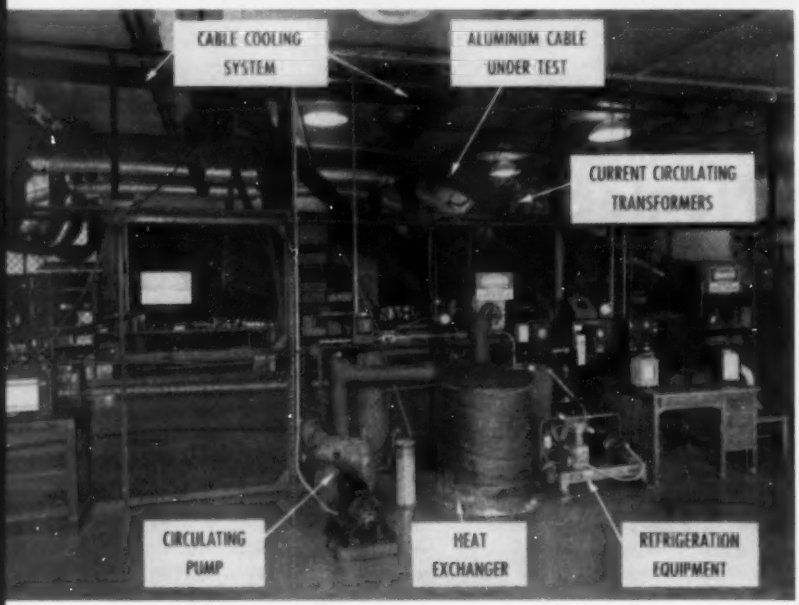
Achievements in growth and technical excellence of the industry would seem to be sufficient evidence for the claim that research efforts to date have been quite adequate. Load growth has been rapid and appears likely to continue so. This is evidence not only of sales effort but of the availability of a continuously increasing amount of satisfactory utilization equipment for the home and for industry. The development of improved lighting, electric heating, air conditioning, electric cooking, washing, and all the other modern convenience devices did not just happen. It has been preceded and accompanied by careful research.

**Progress Fast Enough For Public . . .** In industry the use of 16,000 kwhr per year per worker has been built upon a broad foundation of research. It is believed that developments in utilization of electric power have proceeded about as fast as they could have been absorbed by the public.

This rapidly growing load has been well served. In general, power has been available wherever and whenever it was wanted. Service rendered has been good as to quality—continuity and voltage regulation—and the price has been fair, with a general trend downward over the years. This has

Article based on paper by author before American Power Conference, March 30, 1955

SLAG BRICK TESTS at Armour Research Foundation are watched by the Research Committee of Commonwealth Edison. Utility is also sponsoring fly ash research




IONIZATION TESTING of 120-kv gas pressure cables is one of the research projects of Detroit Edison. Insulating oil and smokestack vibration are among others

"ELECTRIC MOUSE," developed by Consolidated Edison Co, to thread conduits with rope for pulling new cable into place illustrates practical research

# Utilities Have Been

been brought about by remarkable engineering developments in power systems and in equipment, which have kept pace with requirements of the larger and larger loads and load concentrations. No enumeration of these advances is feasible, but a few illustrations are given at the top of the first page.

No one can question the leading part which research has played in these developments—research in metallurgy, in insulating materials, in combustion, in equipment design, in system design. It seems obvious that there has been no lack of forward thinking and of creative action and that the research necessary to carry out these accomplishments has been done.

Could there have been more of it? Could progress and growth have been more rapid? Who can say? At least the electric power industry can take great pride in its past performance.

**The Utilities Share . . .** It seems beside the point to ask if the utilities, the manufacturers, and other agencies have each taken or are taking their proper share in this program of progress. Developments by the manufacturer must be tried out and accepted by the utilities if they are to be useful. Conversely, ideas developed within the utilities must, in many cases, be translated into practical equipment by the manufacturers. There has been excellent teamwork throughout. Many instances of this could be cited. The overall result is the matter of real importance, not who has done what.

**Research Is Not Always So Called . . .** The utilities have, however, made very appreciable direct expenditures for research. Although few of the operating companies have their own research laboratories, many of them are sponsoring research projects by colleges and by research institutes and are contributing individually to other projects sponsored by such organizations as ASTM, Joint Research Council, and other national bodies. Furthermore, there is a great deal of work of a research nature going on in all utilities which is called investigation or study.

The utilities have jointly sponsored an increasing amount of research through the Edison Electric Institute and the AEIC. In addition to financial

# Sponsoring and Doing Research, Often Under Another Name

support of well defined projects, a very considerable part of the work of many of their committees is devoted to investigations, survey of industry needs, opinions, and experience as a guide to improved practices and development of equipment, and to actual participation, many times jointly with the manufacturers, in such developments. Similarly, committees of the various professional societies such as AIEE, ASME, ASTM, and others are engaged in similar activities. By their representation on these multitudinous committees, the electric utilities are contributing substantially to these research activities.

**Utilities' Research Projects . . .** As specific examples of the magnitude of some of these research programs:—

**1.** There are several groups of companies actively engaged in the study of the possibilities of atomic power. The group of 33 companies, of which Detroit Edison Co is a member, was set up to develop a practical, economical, nuclear power plant. It spent $1,940,000 in 1954 and has a budget of $3,800,000 for 1955. This group includes 25 utilities, four manufacturers, and four other organizations.

**2.** Two of the larger utilities have estimated that their yearly expenditure for research, as herein defined, including specific projects, contributions, and related studies, is of the order of ⅓ of 1% of their gross revenue. It is difficult to arrive at exact figures for any one company or for the industry, but the total money now being allocated to research is substantial.

Typical of individual projects are these of Detroit Edison:

- Basic studies on insulating oils.
- Effect of fly ash on strength of concrete.
- Dynamic behavior of high smoke stacks.

**3.** The electric utilities, through the Edison Electric Institute and the Association of Edison Illuminating Companies, are now engaged in eight research projects, either by direct sponsorship or by contributions to other organizations. The total estimated cost of these eight projects is $840,000 of which EEI and AEIC are furnishing $341,000. These include a diversity of subjects such as:

- Effect of high temperature on various metals and alloys.
- Strength of wood poles.
- Application of calculating machines to utility accounting practices.

**Future Program . . .** Past accomplishment should not be viewed with too much complacency as a measure of future action. The real questions which must be faced are:

**1.** What are the problems which need attention if the industry is to maintain its place as a progressive one?

**2.** What should the utilities do in attacking these problems?

**3.** How can the utilities program best be accomplished?

Growth of loads and systems will bring many problems which will quite naturally be solved according to the pattern which has prevailed—partly by the manufacturers, partly by the utilities, and much by cooperative effort. No attempt can be made to enumerate all of the worthwhile projects. A number were suggested recently in papers by Hobson, Lewis and Oldacre, and by Gaty at the AIEE Conference in February 1955 at New York City.

In general, continued progress will require considerable attention to research in all areas—generation, transmission, distribution, and utilization. Here are some possibilities:

**Generation:** Advances into the field of supercritical steam pressures and higher temperatures have already been projected. Much must be done in investigating behavior of materials under these conditions.

Substitution of atomic fuel for fossil fuels is being given much attention and more is necessary.

A vast quantity of coal remains to be burned, and its conservation is highly desirable. Economical methods of removing moisture from coal before shipment and of removing sulphur before burning would pay dividends. A cheap process of gasifying coal at the mine and transmitting gas has great possibilities in simplifying fuel and ash handling problems, reducing air pollution, and stimulating use of gas-fired prime movers.

A practical method of more direct conversion of heat energy into electrical energy would seem to be within the realm of possibility and very worth while.

**Transmission and Distribution:** If loads are to continue to increase, what will the system that will carry them be like? Transmission voltages up to 400 kv have been used, and some study has been given to still higher voltages. Does the future lie in higher and higher voltages, or will a distribution of generating sources be necessary? Practical underground cables are certain to be needed for any system voltage which may be finally adopted.

A better understanding of system transmission losses is needed, both for more economical allocation of generating sources and for improving overall economy. About 15% of energy generated is lost in transmission and distribution. Is this an economical situation? Could some other system or other types of materials and equipment reduce this?

Overhead lines are, at present, an economic necessity. Can their appearance be greatly improved? Is it possible to devise practical competitive underground distribution?

Even though service quality is good, the increasing importance of electric service to the customer and the greater sensitivity of automatic equipment make reduction in interruptions and voltage dips, and closer voltage regulation of greater importance. What can be done to improve this service economically?

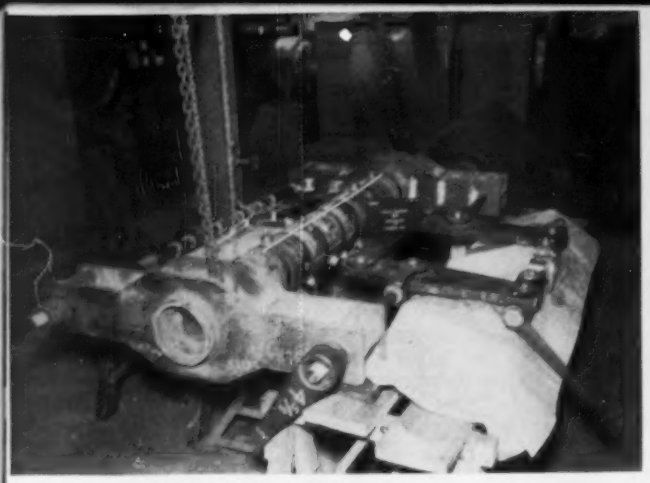
**Utilization:** There are many possible additions to work saving devices. There is need for improved efficiency and economy in electric house heating if it is to be generally accepted in northern climates.

**General:** Opportunities for the use of machine computer technology in engineering work, as well as other areas, would seem to be a fertile field for profitable investigation.

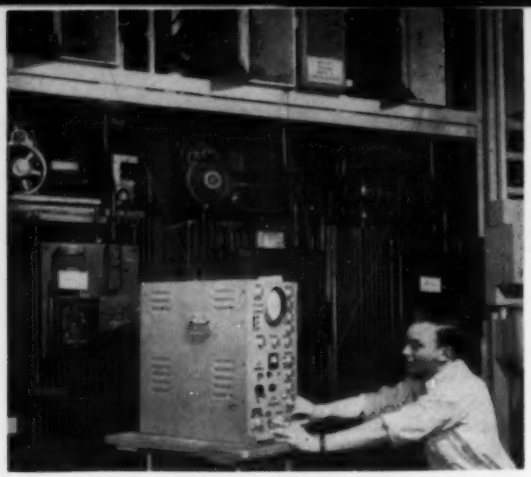
Acceptable basic principles for engineering economic analysis would be very helpful.

These are only some of the things which need attention, but they are indicative. Some are already being studied. There are many more possibilities in non-engineering fields, such as rate making, personnel practices, public relations, and management.

*(Please turn the page)*



CYCLIC HEATING TEST of austenitic and ferritic piping and welds is one of projects of Public Service Electric & Gas Co



RADAR FAULT FINDER has been developed by Commonwealth Edison Co, Chicago, for use on transmission system

**Implementation of Program . . .** In answer to the question—"What should the utilities do in attacking these problems?" It seems that they should do at least as much as they have been doing in the past and that somewhat greater general activity on their part is warranted and highly desirable. It is impossible to define the preferable scope of their undertakings, either as individual companies or as groups in comparison with the scope of the manufacturers and of other agencies, but some indications might be mentioned.

The manufacturers may quite properly be expected to lean strongly to those projects which give promise of producing products which are salable at a good profit. This should not be understood as a criticism. Quite the contrary, the manufacturers in general have done and are doing a surprising amount of long range thinking and basic investigation for which the returns, if any, are certainly intangible.

Utilities will continue to have a large part here in cooperation with them, to stimulate improvements, to work them out in the field, and to criticize constructively. This they will do individually and through their organizations and committees.

**Fields of Research for Utilities . . .** The special scope of the utility industry as a whole would otherwise seem to lie best with those types of projects which:

**1.** Are of particular benefit to the utilities themselves. Operating problems constitute one example.

**2.** Are outside the probable interest of manufacturers or other agencies, at least in the early stages. Some of these can be turned over to manufacturers if they reach the stage of profitable possibilities.

**3.** Are not likely to get done unless the utilities do them, at least not so soon as they are needed.

**4.** Give promise of producing tangible worthwhile results in better service or greater economies.

Greater interest by the utilities in the more nebulous, long range investigations in "pure science," without immediate objectives, has been suggested. Such work is of importance for the future of the industry and should not be ignored. But utilities are subject to regulation. Expenditures for tangible objectives of better service or economy are clearly justifiable, but undue emphasis on remote possibilities must be approached with caution.

**An Industry Lab? . . .** Similarly, the proposal which has been made for a separate industry laboratory is a questionable one, at least for the present. Many existing laboratories in the country, in colleges, and in independent organizations are capable, willing, and anxious to do research for the utilities. Let us use these to the fullest advantage before considering the establishment of others.

Increased sponsorship of suitable research projects by individual companies, either within their own organization or by outside agencies should be encouraged. It is difficult to specify which projects can best be handled in this manner and which should be approached collectively. In general, the individual company can undertake those things which are of the lower order of cost, are of more immediate need, especially to that company in its operations, and for which adequate facilities are available within the company or near at hand. It is to be expected that many such projects will benefit other companies and the industry as a whole as well as the sponsor. In general, individual sponsorship is preferable to group sponsorship when feasible. For the broader scale projects, however, cooperative action through associations or societies are required.

**Need Coordinating Agency . . .** There is a very real present need for a central organization which will:

**1.** Correlate and coordinate the large amount of research work which is done by the individual utilities.

**2.** Stimulate and direct new projects which appear desirable for group action.

**3.** Publicize the activities and the results being accomplished in both areas.

This would reduce duplication of effort and waste of funds and would increase the awareness of the value of research both within and without the industry. It would seem that these objectives could best be accomplished by the Edison Electric Institute Research Projects Committee. It has been active in studying and screening projects proposed by various other EEI committees and also those for which support has been requested by outside agencies, recommending the ones which appear to be suitable to the board of directors for its decision.

This activity has been increasing during the three or four years of the existence of this committee and could well lead to the establishment of a full time staff for the purpose under the general direction of a volunteer committee.

# OPERATION VOLTAGE REPORT NO. 1

## Key facts in the application of regulators and capacitors

| | REGULATORS | CAPACITORS | REGULATORS AND CAPACITORS |
|---|---|---|---|
| QUALITY OF REGULATION | Maintain ±1 volt control in small steps | Produce fixed voltage rise depending on bank size | Provide better regulation than regulators or capacitors used alone |
| SYSTEM LOAD CAPABILITY | Raise output capability by virtue of increased output voltage | Raise capability of whole system and reduce thermal loading | Provide maximum system load carrying ability |
| REDUCTION OF LOSSES | Some reduction results from higher voltage, producing lower current for a given load | Reduce $I^2R$ and $I^2X$ loss on entire system | Provide economical reduction of system losses |
| VOLTAGE CONTROL DURING EMERGENCIES | Output voltage restored after short time delay within range available | Help sustain system voltage | Maintain highest emergency voltage level |
| LIGHT AND HEAVY FEEDER LOADS | Economical to install at lighter feeder loads | Economical to install at heavy feeder loads | Most economical at any feeder loading |

## Conclusion: FOR MAXIMUM ECONOMY USE REGULATORS AND CAPACITORS

Recent surveys show that most utilities are planning some means of voltage control on almost 90% of all their distribution feeders.

Since this represents a sizeable investment in equipment, G-E engineers have undertaken a comprehensive study of feeder voltage regulation problems to help utilities choose the equipment that provides economical voltage control.

The increasing use of capacitors as a means of regulating voltage has naturally led some engineers to look upon them as competing with regulators. This is not the case, since there is a definite place for each on any system.

The most important result of the analysis is that: When used jointly, capacitors and regulators *always* give superior voltage control, and greater return on system line and substation investment.

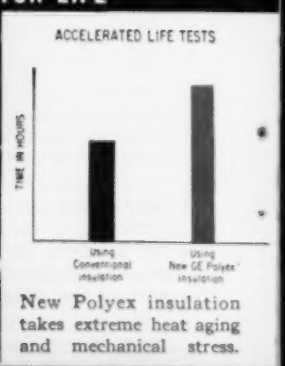
This is the first in a series of reports dealing with the important conclusions drawn from the study. For a complete discussion contact your G-E Sales Engineer for GER-1029 or write General Electric Co., Schenectady 5, N. Y. 645-1

**PORTABLE DEMONSTRATOR being used by G-E Engineers R. M. Butler (left) and D. R. Samsen to show effect of capacitors and regulators under variety of feeder load conditions.**

GENERAL ELECTRIC

**AN ELECTRODE'S EYE-VIEW** of a high voltage blast shows how General Electric's new Polyex insulation can withstand greater voltage—without breakdown—than any other Class A insulation in use today.

## 50% LONGER MOTOR LIFE




New Polyex insulation takes extreme heat aging and mechanical stress.

**For users of motors from 100 to 3000 hp...**

# G.E. Develops NEW Insulation That Is 7 Times Tougher—Adds 50 Percent to Motor Life

## Revolutionary *POLYEX* insulation gives added margin of protection against motor failures—reduces maintenance costs.

General Electric has developed a complete new insulation for form-wound coils which lasts 50% longer than any other Class A insulation in use today. Its greater ability to withstand physical and thermal stresses, and resist contaminants, provides an added margin of protection that will mean tremendous savings to you because of reduced motor failures and reduced maintenance costs.

**POLYEX INSULATION** is a balanced system of polyester films and fibres, together with new hydrocarbon resins. For the first time, materials used are inherent insulators in themselves, and the cotton and paper-based tapes and sheets, used in conventional insulations, have been eliminated.

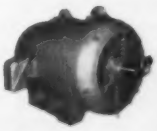
**A FEW OF THE EXHAUSTIVE TESTS** on new Polyex insulation are summarized on these pages. Insulation qualities like these offer you tremendous savings in motor maintenance and a greater degree of service continuity than ever before possible.

**FOR FURTHER INFORMATION,** contact your nearby G-E Sales Representative, or write for Bulletin GED-2460, Section 830-15, General Electric Co., Schenectady 5, New York.

***HERE ARE G-E LARGE MOTORS EQUIPPED WITH POLYEX INSULATION***

**Vertical TEFC**

**Vertical Weather-Protected**



**Totally-enclosed fan-cooled**

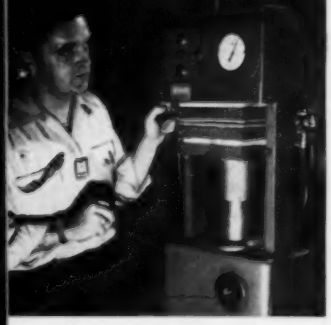
**Open Dripproof**

**Grade-mounted weather-protected**

**Base-ventilated weather-protected**

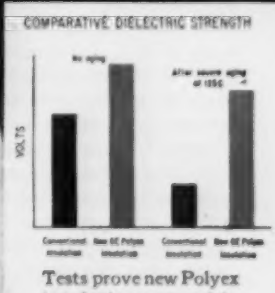
**Totally-enclosed air-water cooled**

## 7 TIMES GREATER PHYSICAL STRENGTH



Cut through test proves G.E.'s new Polyex insulation has extra protection against much greater physical stress.

## 50% HIGHER DIELECTRIC STRENGTH




Tests prove new Polyex insulation can withstand much higher voltage stresses.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

# New Relay Scheme Protects Floating-Wye Capacitor Bank

P. M. MINDER, Application Engineer, Line Material Co, Milwaukee, Wis.

A new relaying scheme has been developed to protect floating-wye, single series group, capacitor banks where the split-neutral scheme is physically or electrically impractical. The easy-to-install scheme requires three current transformers and one relay. It is as sensitive as the split-neutral scheme but costs less than any known scheme that can replace the split-neutral scheme.

The three current transformer method supplements fuse protection and senses harmful unbalance caused by fuses blowing or other conditions. Usually, scheme is adjusted to operate when overvoltage reaches 10% and either disconnects the bank or energizes an alarm, or both.

Three CT's with 5-amp secondaries and 10- or 15-amp primaries are employed. One CT is inserted in each phase between the neutral of the bank and the neutral terminal of a capacitor. Current through the capacitor also flows through a CT winding. Windings not connected to a capacitor are connected in parallel to a relay.

CT's may be mounted either on the insulated frame or on the grounded structure. Application of the scheme with the insulated neutral frame, shown, requires that capacitor current flow through a CT secondary. With the CT's mounted on a grounded structure the capacitor current flows through a CT primary. These connections are dictated by the capacitor currents and CT ratings.

If single-bushing capacitors are used, the three capacitors with the CT's in series must be insulated from the [illegible]. If two-bushing capacitors are used, no additional insulation is required. The table lists data pertinent to the selection of CT's and relay operating range.

### Voltage Unbalance Operates Relay

Under normal conditions, with all capacitors operating at rated voltage, the current through each CT is the same. Therefore, the vector sum of the currents through the relay is zero. If unbalance occurs within the capacitor bank, it is reflected in the relay circuit. If sufficiently large this current actuates the relay which either energizes an alarm or trips the circuit, or both.

Possible cases of unbalance and their effect are:

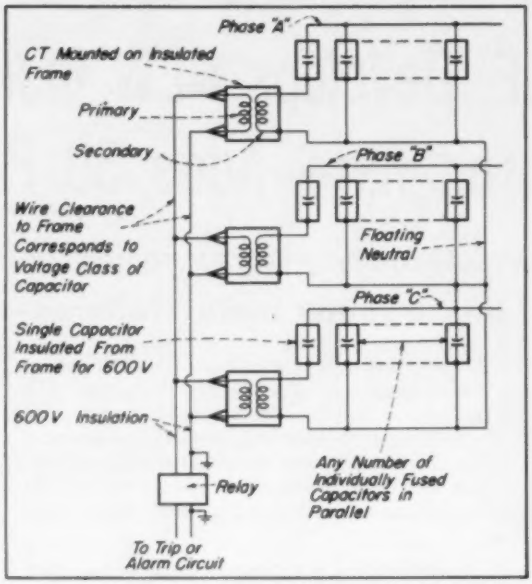
**1.** If a sufficient number of capacitors in one phase have been disconnected by individual fuses resulting in a 10% overvoltage, the CT current in that phase increases an equal percentage. Due to neutral shift the CT currents in the other two phases decrease. The vector sum of the currents through the relay is 30% of the rated current through one capacitor (1:1 ratio). This actuates the relay.

**2.** If a short circuit occurs between one phase and neutral, no current flows through the CT in that phase. The sum of the current through the CT's of the other two phases is 300% of the rated current of one capacitor, and it is detected by the relay.

**3.** If the capacitor connected to a CT becomes disconnected, no current flows through that CT. Sum of currents through the other two CT's is nearly rated unit current. Therefore, the sensing relay is actuated.

**4.** If one phase becomes disconnected, the neutral shifts to the mid-point between the two remaining phases, and these two phases are energized at 86% rated voltage. This is not harmful, so the protective scheme does not operate. Resulting current in the relay circuit is zero.

The three current transformer scheme is economical because it requires only three CT's, rated at phase-to-neutral voltage, and one relay. Three CT's for a 15-kv bank cost about 25% of the price of three PT's rated at phase-to-phase voltage. For a 5-kv bank the savings are about 40% in favor of the CT's.

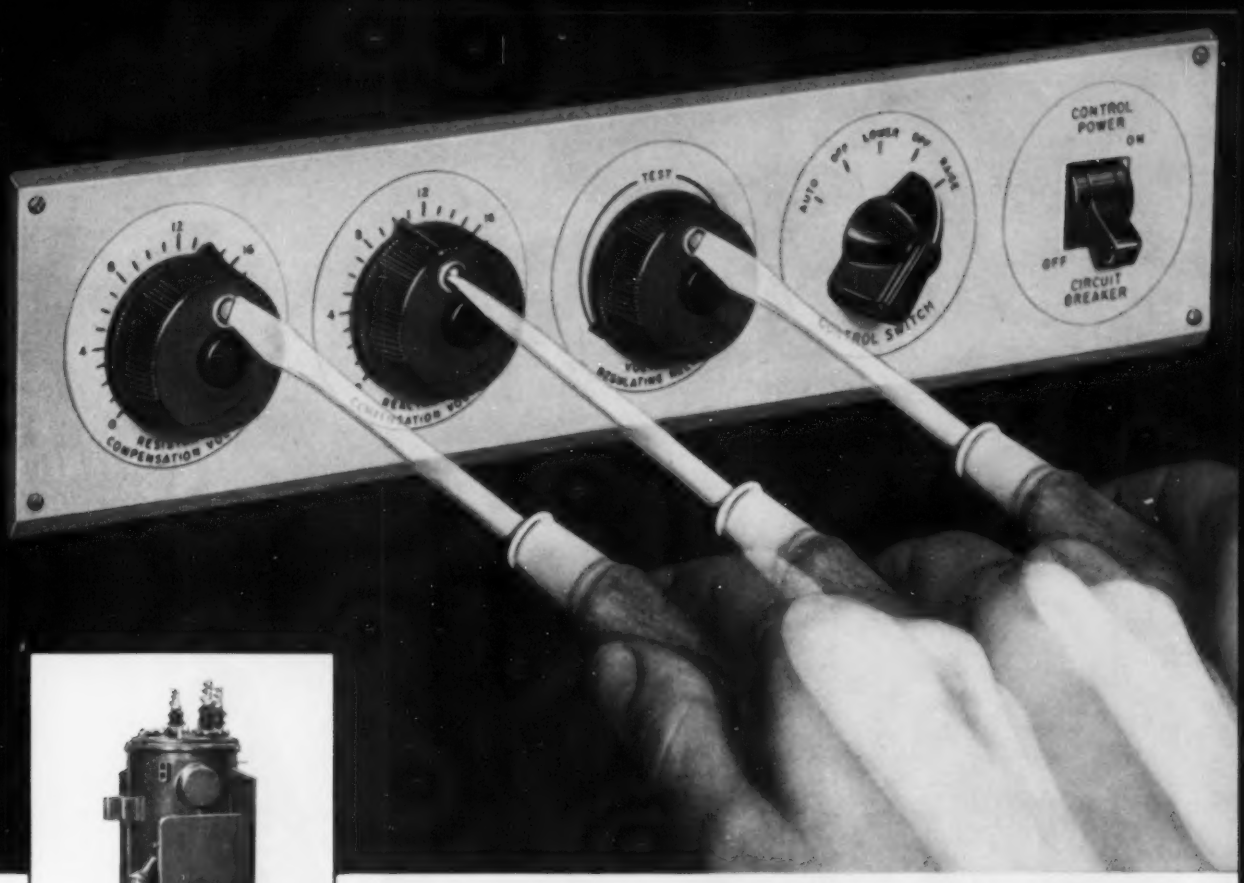


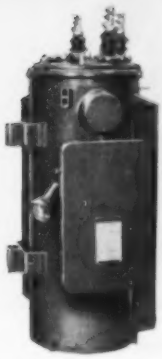

**THREE CURRENT TRANSFORMER scheme should be applied to supplement fuse protection for capacitor banks, rated over 600 kvar, when split-neutral scheme is not practical**

## Selection of CT and Relay Operating Range

| Rated Capacitor Voltage Kv | CT Mounting Scheme | Rated Capacitor Current Amp | CT Current Ratio | Secondary Current for 10% Unbalance Amp | Recommended Current Range of Relay Amp |
|---|---|---|---|---|---|
| 2.4 | ↑ | 10.4 | 15:5 | 1.04 | 0.5 to 2.5 |
| 4.16 | On Grounded | 6.0 | 10:5 | 0.90 | 0.5 to 2.5 |
| 4.8 | Structure | 5.23 | 10:5 | 0.78 | 0.5 to 2.5 |
| 6.9 | ↓ | 3.63 | 10:5 | 0.54 | 0.5 to 2.5 |
| 7.2 | ↑ | 3.47 | 5:10 | 2.08 | 0.5 to 2.5 |
| | On Insulated | | 5:15 | 3.12 | 2 to 6 |
| 7.96 | Frame | 3.14 | 5:10 | 1.88 | 0.5 to 2.5 |
| | ↓ | | 5:15 | 2.83 | 2 to 6 |

(*More How To on page* 126)



**ONLY G.E. GIVES YOU ALL THESE FEATURES—**

**Greater Accuracy**

- Class 1 Control Accuracy
- Control Dial Locking
- Control Test Rheostat
- Rheostats for LDC Adjustments

**Longer Life**

- Opti-Life Tap Switching
- One-Piece Cover Band
- Super-Melaglyp Paint
- Nitrile Rubber Gaskets
- Electrostatic Shielding

**Superior Service**

- Flat Upper VRR Contacts
- Up to 120-Sec. Time Delay
- Handy Meter Shelf
- Cushion Mounted Cabinets
- Internal By-Pass Protection
- New Mercury Limit Switch
- Spring Mounted Worm.

**DO YOUR FEEDER REGULATORS GIVE YOU**

# "Sure set" dial locking for maintaining accuracy

It's *another* of the new features in General Electric's voltage regulator line that means better regulation. "Sure set" locking screws on all dial control adjustments make sure that your control settings are held precisely accurate.

Take both line-drop compensator dials, for example. They let you make highly-accurate linear adjustments. And when you tighten the "sure set" screws, there is no chance of accidentally jarring the controls or of anyone making unintentional changes in adjustments. All regulators have this new "sure set" control dial locking feature . . . and all ratings both step and induction type.

**15 more features,** many just introduced into G.E.'s 1955 line of feeder voltage regulators, give you greater control accuracy, longer life, superior service. Add up these features—you get the most advanced line of feeder voltage regulators, both step and induction, that is available today. General Electric Company, Schenectady 5, New York. 4135

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

**ENGINEERS WILL PREFER** the new G-E cutout. It meets practically all cutout needs. One housing and four interchangeable doors offer maximum flexibility and maximum economy.

# G.E.'s ALL-NEW LINE OF

**SAFETY-GRIP DOOR** means fumble-proof handling with a conventional switchstick, as well as easy manual handling of door with gloved hand, from right, left, or below.

**"V" WEDGE CONTACTS** combine all the requirements for long service life. Unique construction enables positive high-pressure, multi-point, low-resistance surface contact.

**COMPRESSION CLAMPING** of hanger support gives maximum durability. Mechanical and thermal tests show support withstands stress and strain far beyond normal service.

**LINEMEN WILL LIKE** the new G-E cutout. It is easy to use with many new features like the safety-grip door with natural thumb-and-finger holes and the easy-to-open shipping box.

# ENCLOSED FUSE CUTOUTS

## Now available in 50- and 100-amp ratings 5.2 and 7.8 Kv

General Electric's important new fuse cutout development offers new economies and safety features. Every standard need is satisfied by four doors which are *interchangeable in one basic housing.*

The new G-E Enclosed Fuse Cutout supersedes three former lines: Enclosed, Indicating and Drop-out; Non-indicating Enclosed and Heavy-duty Enclosed (except the 200-ampere rating). When you standardize on this new line you stock fewer parts, inventories are smaller, storage and handling costs are less.

The many desirable features in the new line were based on hundreds of reports collected by G-E engineers. To name just a few besides the features shown graphically at the left, you'll find fusing is simplified, line terminals are tin-plated to minimize corrosive effects, and neoprene barriers help protect against internal flashovers.

For more information get in touch with your nearest G-E Apparatus Sales Office or Agent. Or write for Bulletin GEA-6208 to General Electric Company, Section 433-8, Schenectady 5, New York.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

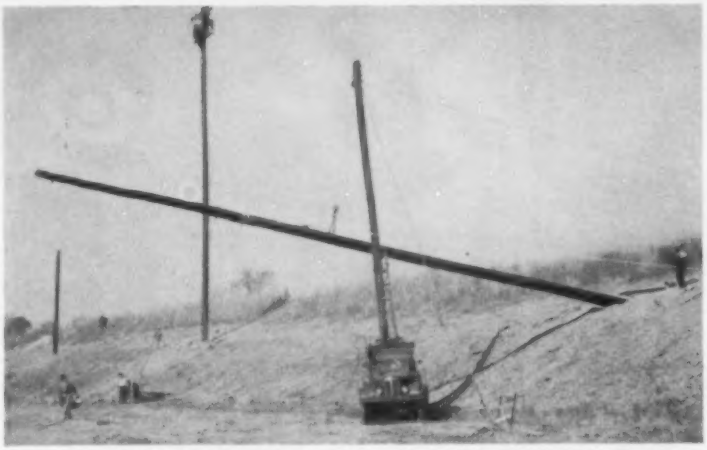
# Portable Gin and Two Truck Winches Raise Long Poles

**W. W. BRUNSON**, Engineer, Office of Distribution, Alabama Power Co, Birmingham, Ala.

A portable fixed-type gin and two truck winches were used by Alabama Power Co to set 90-ft poles where fixed gin poles could not be placed because of solid rock outcropping. The long poles had to be located on a sharply rising slope 15 ft above a high school athletic field for lighting.

To do the job, a portable gin was made by lashing a 45-ft pole to the boom of a pole-setting truck. Two wraps of ⅜-in. chain secured the pole to both the top of the boom and the truck frame. This rigging was only used to put the gin in position, and once there, stability was provided by three ¾-in. manila-rope guys with the gin resting on the ground.

The portable gin was placed and guyed at the foot of the slope. With the winch on the boom truck a tall pole was raised to an angle of 30 deg above the horizontal. Then, using a truck winch located on top of the slope and in line with the pole, the pole was pulled up against a bucking board and into the hole.



**POLE WAS RAISED 30 deg with a truck winch and the gin attached to boom. Then the pole was pulled upright with another winch (out of picture at right)**

When moving from one location to another, the gin pole was lifted a few inches above the ground with the truck winch.

**TRANSPORTING HOT STICKS in a protected covering is the purpose of this special trailer, costing $700 to make**

**FOAM RUBBER was used to line the slotted racks to prevent end play and abrasion of sticks while in transit**

# Trailer Protects 24 Hot Sticks During Transit

**VERNON P. WILLIAMS**, Distribution Engineer, Ohio Power Co, Wooster, Ohio

A trailer to protect 24 hot sticks, up to 12 ft long, during transit has been developed by the Wooster group of the Ohio Power Co. It has readily accessible racks for 16 12-ft sticks, five 9-ft sticks, and three 8-ft sticks. Bin space of 45½ sq ft under the sticks is available for small tools and accessories.

The 13 x 4 x 3½-ft box is made of ¾-in. exterior-grade plywood screwed together and sealed to 2 x 2-in. corner strips with marine glue. Doors are ¼-in. wall board. Standard 4 x 8-ft sheets of plywood and wall board used avoided paying a premium for larger sheets.

The box is mounted on structural steel chassis, springs, and rubber-tire wheels. A swing-down leg on the tongue permits unhitching the trailer and parking it level.

Door hinges are covered with single-treated canvas weather seal, and edges of doors are sealed with rubber weather stripping. Braces that hinge down from the doors snap into catches in the box and hold the doors open securely, thus preventing wind kicking out the braces or blowing the door upward. To close the doors, the braces are swung up into snap catches on the doors, which are held closed by spring catches.

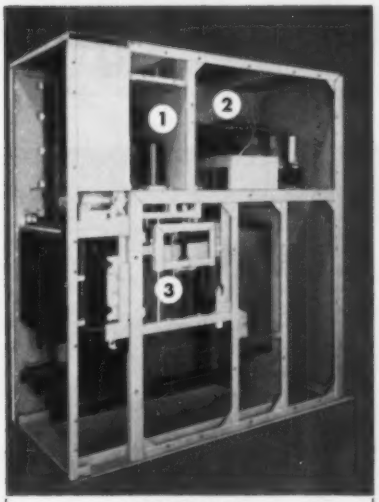
Slotted racks within the box hold the hot sticks. They

(*Continued on page* 130)

*Photo courtesy of Fort Worth Star-Telegram.*

# Flood Makes G-E Switchgear Prove Its Quality

**G-E Metal-clad units stayed in operating condition, needed only minor cleaning**




**HERE'S WHY**

G-E switchgear was virtually undamaged by flood. Bus (1) and current transformers (2) are located at top. Vertical lift design keeps breaker (3) off floor.

Even though several inches of water actually flooded the lower compartments of the General Electric Metal-clad switchgear at this Fort Worth plant, no vital parts of the units were affected. Although not designed for "flood duty," the advanced features which make G-E Metal-clad units best under ordinary conditions also helped in this emergency.

Take, for instance, the vertical lift feature which kept the breaker mechanism safely above the floor. This design improvement was originally introduced as a safety measure—so personnel could actually *see* the disconnect. Mechanically operated, it includes shutters which automatically close over the stationary contacts for maximum protection.

Away from the danger of flood, the bus is housed at the top of the cabinet in a totally enclosed, Self-X insulated compartment. Structurally stronger, this arrangement also provides greater electrical protection. The current transformers, like the bus, are also enclosed in a separate compartment, well ventilated for greater protection against excessive humidity. For information on how *your* plant can benefit from the plus values of G-E Metal-clad switchgear, contact your nearest G-E Apparatus Sales Representative or write for bulletin GEA-5664, General Electric Company, Schenectady 5, New York. 511-9

*Progress Is Our Most Important Product*

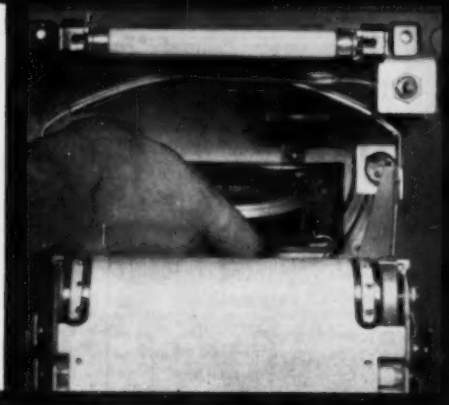
GENERAL ELECTRIC

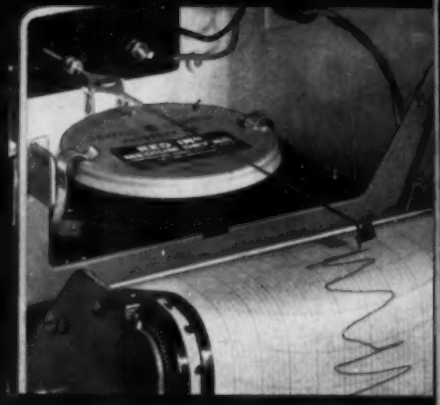
Instruments for Productive Maintenance

**NEW G-E RECORDER**, designated Type CH, has two modern styles in switchboard cases, in addition to the portable shown in operation above. Checking the efficiency of a lathe is just one of many applications of this new, versatile general purpose instrument.

REVOLUTIONARY WRITING SYSTEM ELIMINATES

## New G-E Recorder Makes Clear Records Accurate and Easy to Read





**NEW PLASTIC INKWELL** holds full 3 ounces or triple amount of open kind. Comes sealed ready for insertion. You waste no time —spill no ink. After use—throw it away.

**STURDY CONSTRUCTION** of inking system combines fine writing qualities with extra long life. A highly polished, special alloy pen point reduces wear to a minimum.

***GENERAL ELECTRIC ANNOUNCES . . .***

# NEW General Purpose Recorder

## G-E RECORDER ASSURES LOW COST, PRECISE MEASUREMENTS, SIX BIG ADVANTAGES INCLUDE FIRST THROW-AWAY INKWELL

General Electric's new general purpose recorder is more serviceable, versatile, readable and durable than any other recording instrument available today—plus having the first throw-away plastic inkwell in recorder history. Charting a continuous record of an electrical quantity against time, different models of the new instrument can measure and record current, voltage, power, frequency or speed.

**REVOLUTIONARY NEW** inking system assures a clear, clean record and eliminates the problems of open inkwells found in all other recorders. The new G-E recorder provides six major benefits: Servicing time and costs are cut in half, spring clock runs up to 60 days, 28 different chart speeds are available, instrument is durably built for long life, records are easy to read, and maintenance is simplified.

**FOR FURTHER INFORMATION,** contact your nearest G-E representative, or clip and mail the coupon below.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

TROUBLESOME SERVICING OF OLD STYLE INKWELLS

SECTION A582-1
GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

Please send me the colorful, easy-to-read bulletin GEA-6204 on the new G-E Recorder.

Name.....

Company.....

Street.....

City.....Zone...State.....

**G-E RECORD ROLLS** are 150 feet long and service is simple and easy. Handy side paper indicator tells quickly how much is left on paper roll, saves time, steps.

**EASY-TO-HANDLE** portable G-E instrument gives dependability throughout rough operations, as do other two models. Service, when needed, is quick and easy.

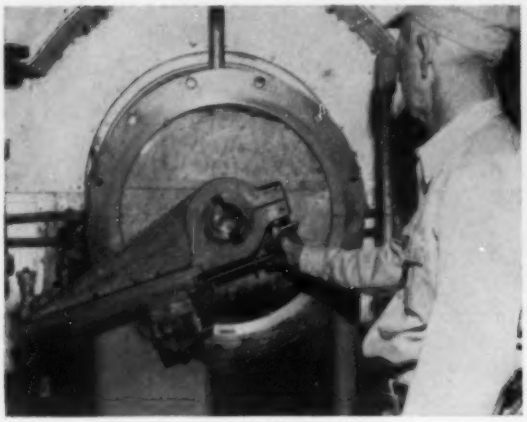
## Hot-Stick Trailer

(*Continued from page* 126)

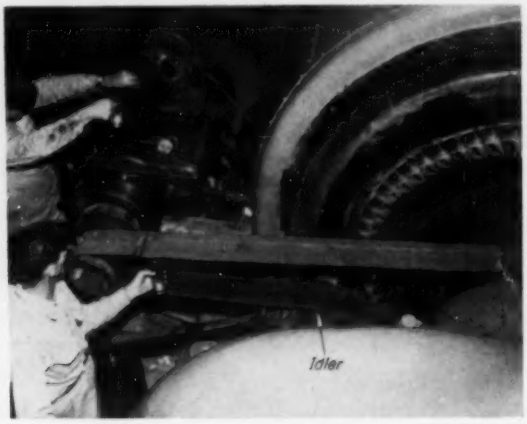
are made from ¾-in. plywood and lined with ¼-in. foam rubber to prevent end play and abrasion of sticks during transit.

No provision is made for heating or ventilating the trailer because it is stored in a heated garage. However, a portable fan is used periodically.

Cost of material and labor for the trailer was less than $700. This excludes salvaged wheels and axle from an old trailer. A breakdown shows that $138 in lumber, $21 in paint, $171 in other materials, and 180 man-hours were required for making the trailer.



CUTTING TOOL driven by turbine shaft machines the flange face to proper alignment. Face of flange was as much as 0.21 in. off




TURBINE DRIVE consists of canvas belt and idler driven by 3-hp lathe. Turbine was rotated initially with overhead crane line

# Tool Mounted on Turbine Shaft Machines Flange Quickly

**A. R. MORRISON**, Southwestern Public Service Co, Amarillo, Texas

An untrue flange on a turbine was machined to proper alignment by driving a cutting tool with the turbine shaft at the Jowett Steam Plant of Southwestern Public Service Co, Amarillo. Machining-in-place took 1½ days and eliminated extra labor and a long outage at the plant.

The flange face on the front end of the turbine was as much as 0.21 in. out of alignment. A true-up was necessary to re-align the oil pump and governor drive during installation of a new oil drive mechanism. The problem was solved by mounting the cutting tool on the turbine shaft and driving it slowly to give equal and even cuts across the entire face of the flange.

Power to turn the shaft was provided by a lathe gear-head operated by a 3-hp, 1,750-rpm motor. Geared down to 12 rpm, the lathe chuck rotated a length of 8-in. pipe. A canvas belt around the pipe and the turbine-generator coupling drove the turbine shaft at 4 rpm. To control the belt, an idler wheel was made from a metal roller and scrap steel angles. A 5-gal bucket of oil was satisfactory to counterbalance the idler arm.

The turbine shaft was initially turned over by hoisting up on a line from an overhead crane that had been passed around the shaft. With the turbine rotating slowly, the belt drive was tensioned and the gear-head drove the shaft Use of a loose belt and idler as a clutch protected the lathe from damage when the machining was stopped.

# Thorough Planning Permits Quick Substation Move

**GEORGE E. HERVEY**, Charleston District Supt, Appalachian Electric Power Co, Charleston, W. Va.

Thorough planning recently enabled the Appalachian Electric Power Co to pick up a substation, move it over a mountain, and cut in service at the new site, all in 6½ hr. Very close co-ordination of sections of the transmission and distribution department was capped off by a virtual "blitz" operation on switch-over day.

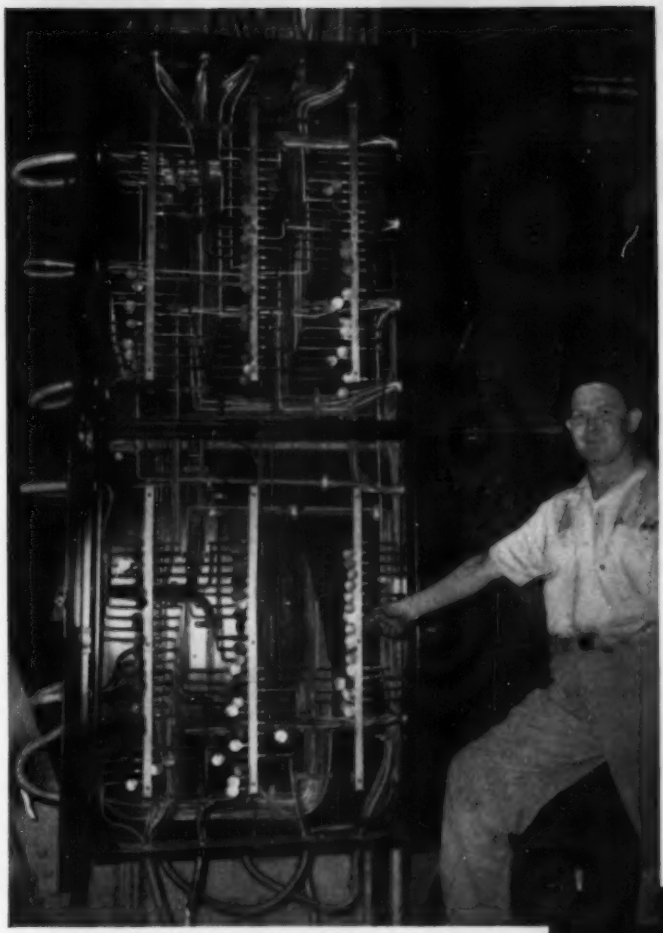
When Amherst Coal Co closed its mine at Point Lick, W. Va., it opened a new one across the mountain at Hunt Hollow, calling for relocation of the 3-phase, 44-kv transformer.

Construction of the 44-kv line began a week after cutting of right-of-way started. Materials, previously ordered, were available as fast as they were needed. While line construction and right-of-way clearing progressed, the substation section prepared the transformer frame and foundation at Hunt Hollow. At the same time, the meter section set up a metering pole which was completely framed and equipped. Necessary wire materials were spotted so

(*Continued on page* 139)

FOR INSTRUMENTATION AND CONTROL

# Cabled Tube



Some time ago Revere ran an advertisement featuring Crescent Armored Multitube for use in pneumatic and hydraulic instrumentation and control systems. The advertisement created so much interest that we thought you might like to see a photograph of an actual installation. The Control Board Junction Box shown here has 22 runs of Multitube coming into this box comprising 224 Revere Copper Tubes of 1/4" O.D. The picture was taken in the Glenwood Landing, N.Y. Power Station of the Long Island Lighting Company. The tubes go to instruments that report information on temperature, main and reheat steam pressure, boiler feed and condensate pump pressure, fuel oil and gas pressure, liquid levels, tide level and for the control of fuel feed, draft dampers, boiler drum water level and various control valves.

This is a relatively new use for Revere Copper Tube, but it is an important one in these days when new ways are being found to obtain process information more quickly and accurately, or to achieve automatic control. Crescent Armored Multitube is made by Crescent Insulated Wire & Cable Co., Inc., Trenton 5, N.J., in lengths up to 1,000 feet. It consists of a group of long tubes twisted together in cable form, protected by a flexible interlocked galvanized steel armor, or by plastic, or both. As many as 19 tubes, 1/4" O.D., can be cabled, with one tube in each layer color-coded. Larger tubes can also be cabled, including 5/16", 3/8" and 1/2". This construction affords protection during shipment, installation and use, and speeds up installation greatly. For further information, write Crescent, and for tube in copper and aluminum, see the nearest Revere Sales Office.

**REVERE**

**COPPER AND BRASS INCORPORATED**

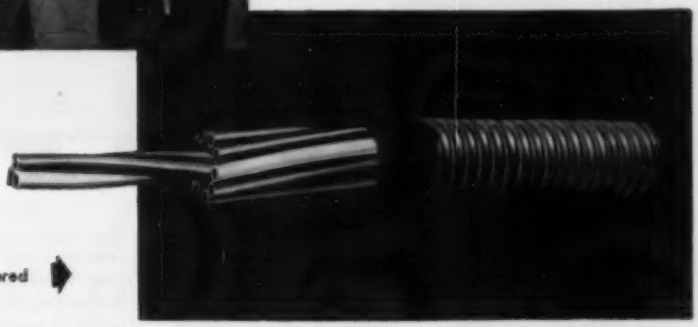
*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

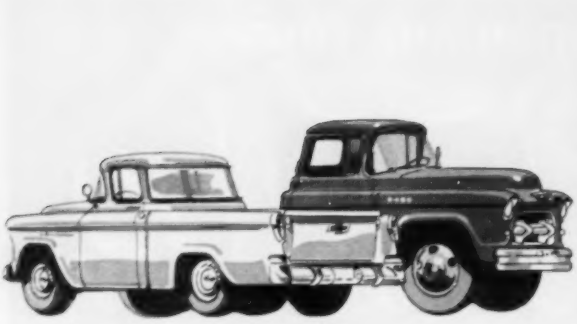
• • •

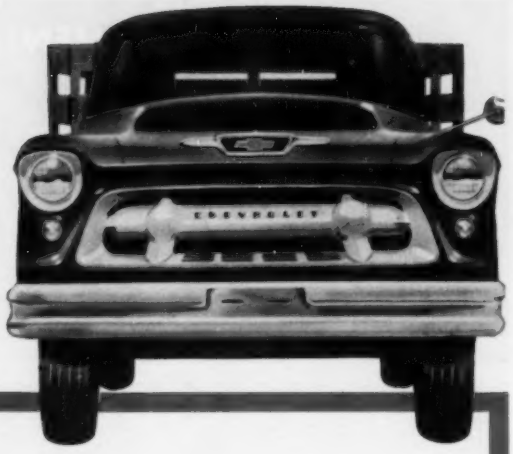
*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.*

Control Junction Box at Power Station of Long Island Lighting Company, showing use of Crescent Armored Multitube. Note that relatively sharp bends can be made without damage to the cabled copper tube.

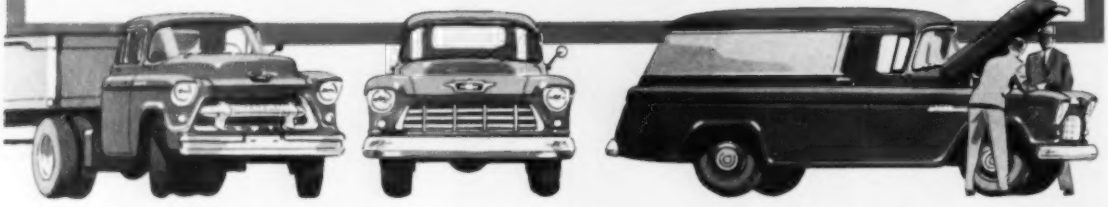


Construction of Crescent Armored Multitube.





# NEW CHEVROLET *Task-Force* TRUCKS

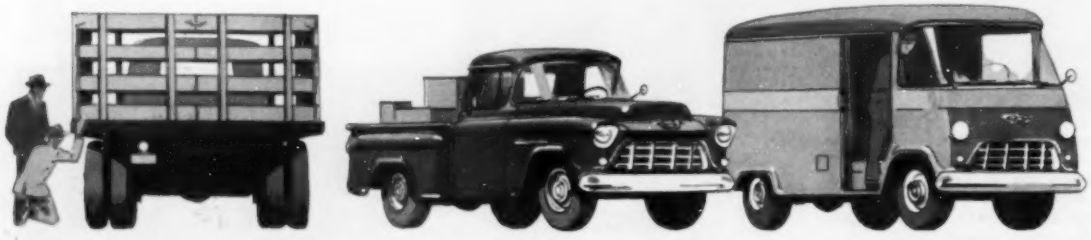


### A new kind of truck styling

It's Work-Styling—an exclusive development in truck design with two distinctively different styling treatments. On the job, your truck "looks the part" and becomes a profitable advertisement on wheels for you and your business.

### New "high-voltage" engines

Six of them! Each with a modern 12-volt electrical system for surer year-round starts and increased generator capacity—plus a long list of other new advances. They're the last word in smooth, quiet and thrifty truck power.

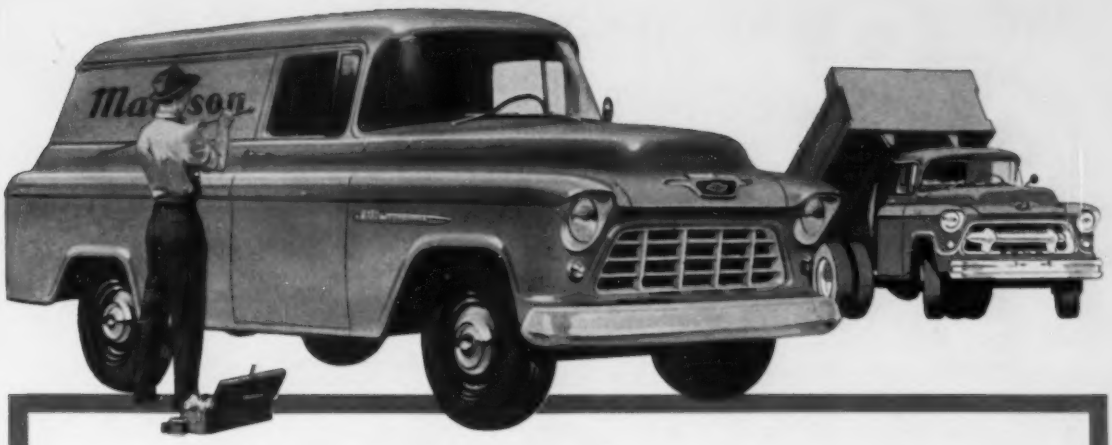


### New frames of standard width

All models now have new ladder-type frames with full-length parallel side members for greater rigidity and longer truck life. Now, too, these newly designed Chevrolet frames are all 34 inches wide to accommodate special body installations.

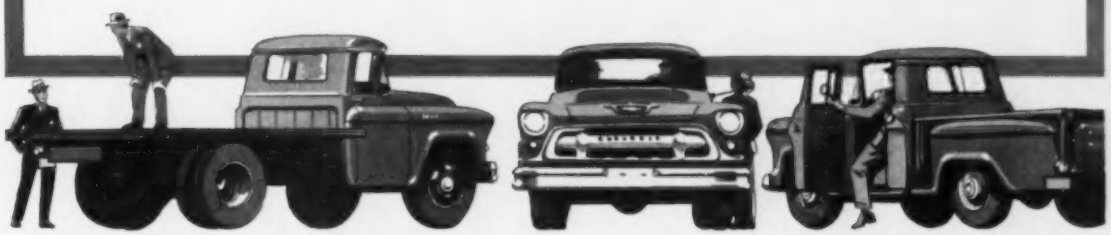
### New Overdrive—Truck Hydra-Matic

For even bigger gas savings and less engine wear, new Overdrive is available on all ½-ton models at extra cost. Hydra-Matic, Chevrolet's thrifty automatic truck transmission, is optional on ½-, ¾- and 1-ton models at extra cost.



CHEVROLET

*They're setting the pace for the whole industry! Take a good look at them here... in the showroom . . . on the road. It won't take you long to discover that these are the most modern trucks on any job.*

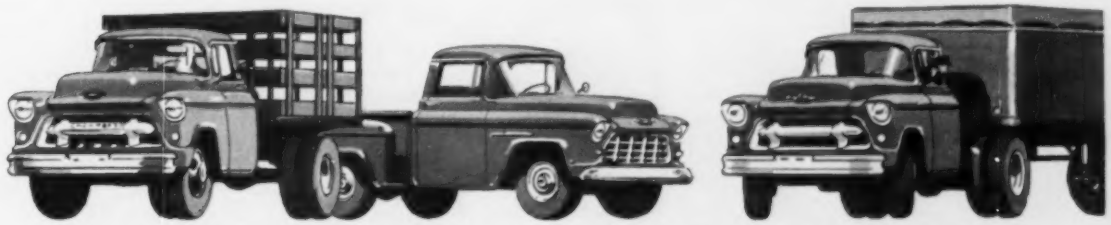


**New 18,000-lb. G.V.W. capacity**

The highest ever for Chevrolet! And that's good news for everyone with heavy hauling to do. For with this hefty hike to 18,000 pounds Gross Vehicle Weight, Chevrolet brings its famous economy and dependability to new heavy-duty fields.

**A cab as new as the view**

New Sweep-Sight windshield—plus more glass all around—for a wider, safer view. New High-Level ventilation for greater driver comfort. New softer seats. New, more durable cab construction. New concealed Safety Steps that stay clear in all weather.



**Power Brakes standard on 2-ton models**

This great power helper increases driving safety . . . reduces driver effort. You stop with up to one-third less pedal pressure—and you do it right now! Chevrolet Power Brakes are standard equipment on 2-ton models —optional at extra cost on all others.

**There's more to tell, a lot more**

Stop in and let your Chevrolet dealer give you the complete "all-new" story. There are many more good things to discover about the New Chevrolet Task-Force Trucks! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

# A Guide to Transformer Weights and Pole Strengths

**Accompanying data are adapted from distribution standards of New England Electric System**

**Application.** Tabulated data will aid in determining the mechanical loading limits of transformer poles. They are intended to apply to the majority of cases encountered. When greater loadings are necessary, the problem should be given specific engineering consideration.

**Pole Loading Limits.** Loading values in Table 1 are given for four kinds of wood poles—Southern Pine, Western Red Cedar, Chestnut and Eastern Cedar.

**Transformer Weights.** Weights in Table 2 combined with the limits given in Table 1 are to be used in obtaining the maximum allowable transformer size in kva. When transformers are in clusters, the total weight is to be used when referring back to Table 1.

**Transverse Loading.** Entirely apart and not effecting values in Table 1, it is noted that poles are to be of sufficient size to carry the transverse wire loading that is placed upon them.

**Hoisting Stresses.** Although a sufficient factor of safety is provided to cover hoisting stresses, wires and guys should be attached before hoisting transformer.

**Examples for Use of Tables.**

**1.** One 15-kva transformer of Pre-World War II design (weight = 500 lb) may be mounted at the top of a 40-ft Class 6 Southern Pine pole.

**2.** A cluster of three 10-kva transformers of Post-World War II design (cluster weight = 780 lb), for top-of-pole mounting would require a 35-ft Class 5 Southern Pine pole; or could be mounted 4-ft from top of pole if a 40-ft Class 4 Western Red Cedar Pole is used.

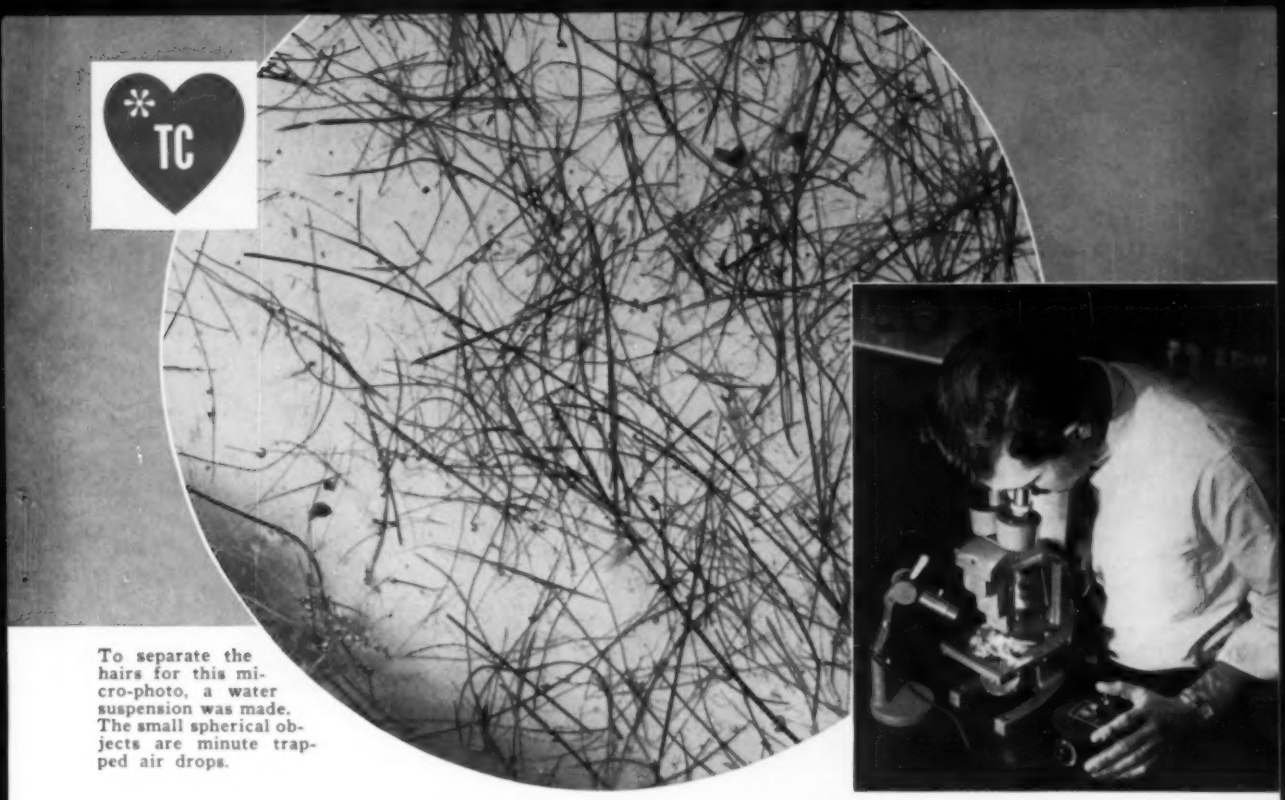
## Table 1—Pole Loading for Transformer Mountings

| Southern Pine Poles,* Length and Class | Transformers Mounted at Top of Poles, Load, lb | Transformer Mounted 4-ft from Top of Poles, Load, lb |
|---|---|---|
| 35-ft Length | | |
| Class 7 | 400 | 500 |
| " 6 | 575 | 750 |
| " 5 | 850 | 1150 |
| " 4 | 1175 | 1550 |
| " 3 | 1600 | 2000 |
| " 2 | 2000 | 2500 |
| 40-ft Length | | |
| Class 6 | 500 | 600 |
| " 5 | 750 | 950 |
| " 4 | 1020 | 1300 |
| " 3 | 1470 | 1900 |
| " 2 | 1800 | 2300 |

* For Western Red Cedar or Chestnut poles, use ⅔ of the above weights. For Eastern Cedar poles, use ½ of the above weights.

## Table 2—Transformer Sizes and Weights for Three Designs

| Size, kva | Weight, lb | | |
|---|---|---|---|
| | Cast Iron Case | Pre-World War II | Post-World War II |
| 3 | 195 | 150 | 130 |
| 5 | 295 | 225 | 155 |
| 10 | 460 | 355 | 260 |
| 15 | 685 | 500 | 307 |
| 25 | 1000 | 675 | 493 |
| 37½ | 1400 | 965 | 715 |
| 50 | 1660 | 1175 | 830 |
| 75 | 2150 | 1540 | 1040 |
| 100 | 2220 | 1780 | 1325 |



To separate the hairs for this micro-photo, a water suspension was made. The small spherical objects are minute trapped air drops.

# We've taken the mastodons out of our insulators

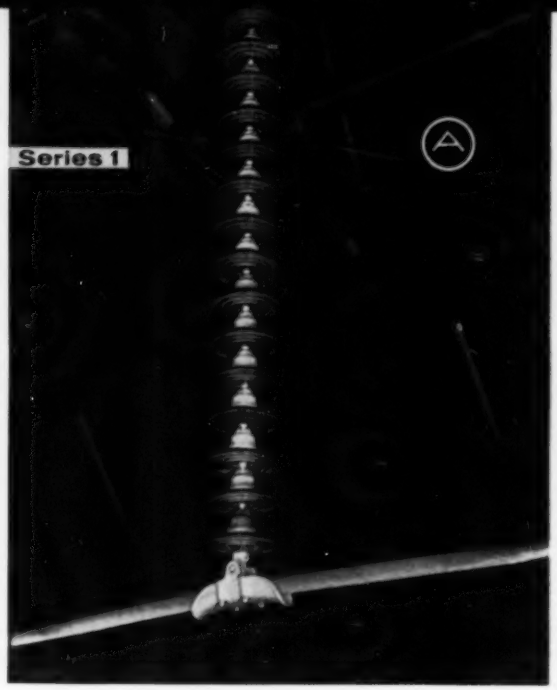
As another step in the highest possible refinement of porcelain insulator clays, we have recently installed auxiliary pressure filters whose unique action and additional processing is an innovation in commercial clay production. The clay, in liquid "slip" form, passes through these pressure filters to remove certain over-sized particles not caught by the regular type of filter.

When these final high-pressure filters are cleaned, masses of a woolly substance are removed. On analysis much of this has been found to be hair -- animal hair! Animals have little or no contact with clays, in mining or later handling; certainly not enough to shed hair in such quantities. Nor do our common animals (or even uncommon ones) have coats with such ranges of color or hair formation.

The apparent explanation is somewhat fascinating. In far-off pre-historic times, when the clay beds were laid down on lake bottoms or stream courses, and when the world was teeming with animals, many lived or died in these waters. Their carcasses disappeared but their hair, which is nearly indestructible, appears to have been trapped and preserved in the dense clay deposits that are now 40 feet or more below the surface. The wad of hair we "moderns" can hold in our hand may have once belonged to animals that inhabited the earth perhaps millions of years ago!

Organic matter such as this is not desirable in clay production. It will burn off in the kiln and produce small voids in the porcelain body. Therefore, we have moved one more step toward the ideal of perfect density. We've taken the mastodons out of our insulators.

TECHNICAL COMPETENCE the heart of every Ohio Brass insulator




# 300-kv transmission

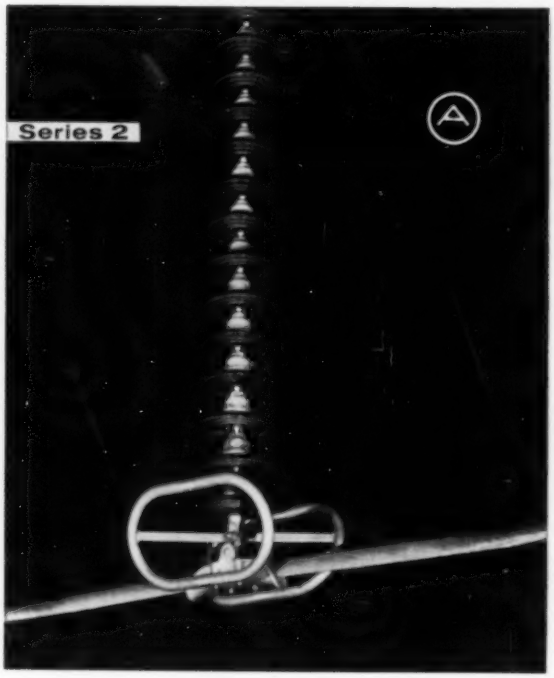
"We wish to observe visual corona at a typical 300-kv suspension point."

As a laboratory project such a request, from some operator is not as simple as it may sound. A long length of conductor, nearly as large as a man's wrist, must be strung under tension and insulated for more than half a million volts. Over ten feet of insulators must be attached to this conductor, with adequate electrical clearances. These physical requirements take sizable laboratory facilities.

Then, of course, there is the equipment to energize this huge specimen at both line and elevated test voltages, along with the rather complicated apparatus to produce rain of known resistance in any desired volume. And to evaluate corona far more accurately than the eye requires radio influence testing instruments capable of working in ranges above 300 kv. To top it off, there must be men with a proper knowledge of extra-high-voltage phenomena to correlate test results.

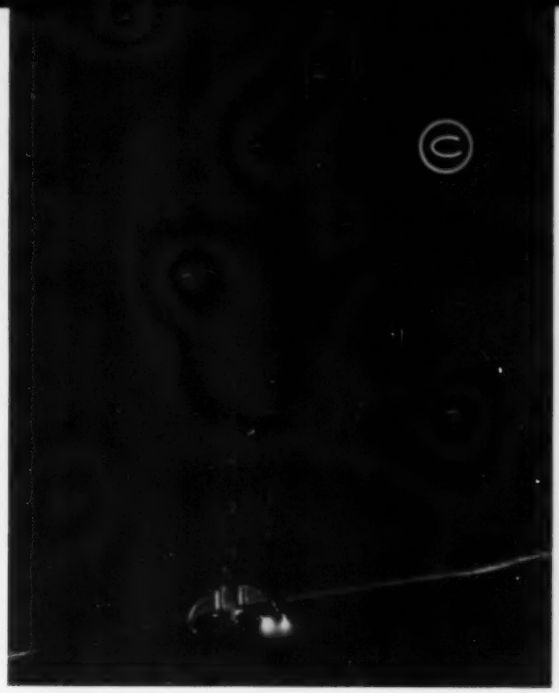
The ability to meet these, and many more special requirements in the modern "super-power" field, has brought us into intimate contact with the insulation and transmission problems peculiar to this new development. And it is a source of satisfaction to know that the O-B High Voltage Laboratory has made a number of basic contributions to this art in the course of conducting research for our associates in the electric power industry.

Naturally this knowledge gained in our laboratory has been reflected in our products intended for 300 kv and higher voltages. Such materials are having their soundness proved-out daily by their presence on *every line* of this voltage class on the North American Continent.

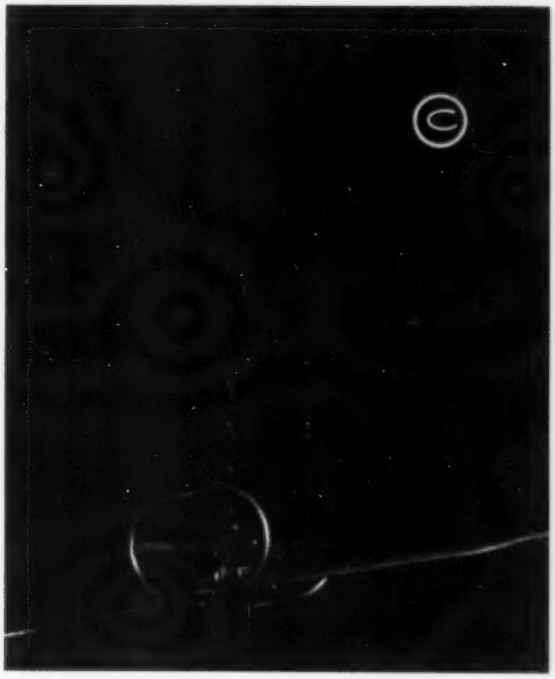



## WHAT THE PHOTOGRAPHS SHOW

Using cable and all other materials exactly duplicating field construction, this suspension point received the following tests for visual corona: SERIES 1, BARE HARDWARE. A, test specimen in full light. B, wet corona. C, dry corona. SERIES 2, WITH CONTROL RING. A, test specimen in full light. B, wet corona. C, dry corona. All tests energized at 60 cycles, 300 kv rms, line-to-ground. Note in 2-C how the control ring under normal dry conditions gives virtual freedom from visual corona at a phase voltage in the order of 500 kv, which was a part of the test conducted at elevated voltage.

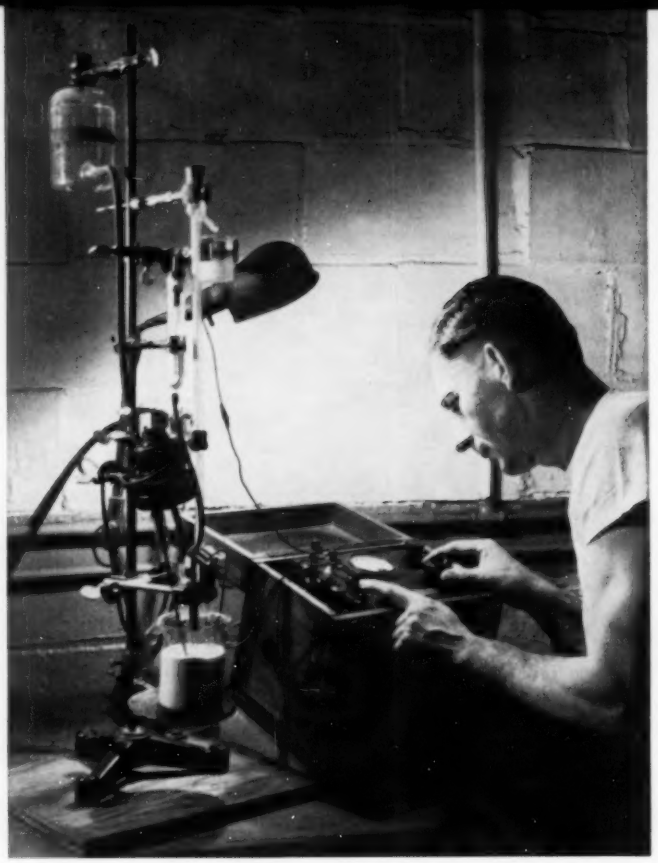



**. . . right under our own roof!**



the heart of all Ohio Brass hardware

# Good homely ingenuity plays its part in Technical Competence



Soft clays used in forming insulators are quite sensitive to pH value (the chemical term for degree of acidity or alkalinity). If too far on the alkaline side, the clay will droop and lose its shape on standing. Therefore, we constantly check and, if necessary, adjust the pH of our clay mix.

This piece of laboratory equipment is the result of ingenious men having done this testing for years. Fundamentally, it consists of two electrodes across which a varying amount of current is generated depending on the strength of the solution. This is compared with an adjustable standard by means of a galvanometer, and a precise pH reading results.

One day a man got tired reaching for his bottle of standardized acid, so he hung it on the machine along with its measuring pipette. This naturally suggested the same treatment for the alkali. Then another man came along with an electric agitator to replace the stirring rod. It ended up with the affectionate name of the "O-B Christmas Tree." The men call it a fine example of "chemical engineering" but admit they have orders to stop hanging things on it before it collapses.

We don't submit this as any triumph of top-drawer science, but it's indicative of good homely ingenuity -- the kind of stuff you find in Technical Competence, the heart of every O-B insulator.

TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

4512-H

## Quick Substation Move

(*Continued from page* 130)

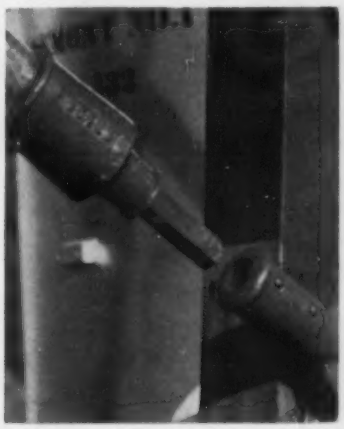
that the span from meter pole to customer's terminal structure could be constructed without confusion on the day of cutting over.

Special arrangements were made to cut over the company's large general store to Appalachian's distribution during change-over. Arrangements included a 12-hr interruption, longest period mining operations could be suspended but enough time for safety precautions before the regular Monday workday.

The operation got under way early Saturday morning. Two substation crews, and one line and one meter crew had been briefed, and as each man carried out his assignment, the job took shape. At 7:07 AM the line was switched out. By 8:45 all leads had been disconnected and the 2,500-kva transformer, loaded on a "low boy," had been started on its 3½ mile trip over the mountain. By 9:30 the transformer was at Hunt Hollow and unloaded, and by 11 it was resting on its new foundation.

Despite a phase rotation reversal causing a half-hour delay the station was energized and service restored by 1:36 PM. The few slides encountered on the road were not serious, and excellent weather was a big factor.

MOVING TRANSFORMER across mountain to new site was done with only 6½-hours service interruption as result of thorough planning



TAILORED FOR THE JOB, a ground switch socket (left) has a cylindrical segment added, and its associated handle (center) has one side of the pin flattened. The by-pass switch socket (right) has a pin added in the center, with its associated handle drilled to take this pin

# Modified Switch Handles Prevent Operating Errors

**EARL T. MELDRIM**, Substation Superintendent, East Bay Division, Pacific Gas & Electric Co, Oakland, Calif.

Where ground and by-pass switches are operated with similar wood handles, serious switching errors may be prevented by tailoring the handles to fit one type of switch only, but not both types. The modifications used by Pacific Gas & Electric are simple and inexpensive, but virtually fool-proof.

For the ground switch, a longitudinal segment of a cylinder is screwed into the socket, and the metal pin on the ground switch handle is flattened to fit the modified socket. The ground switch handle is painted red to denote use only for grounding equipment.

On the by-pass switch, a pin is inserted in the operating socket, and the end of the by-pass switch handle is drilled to fit over this socket pin.

These modifications make it impossible for an operator to inadvertently place the handle in the operating socket of the wrong switch. Furthermore, the red ground handle will insure that he selects the proper handle in the station upon receiving switching instructions.

Modification of either switch handle does not interfere with its use for operating circuit breaker disconnects having an unmodified operating socket.

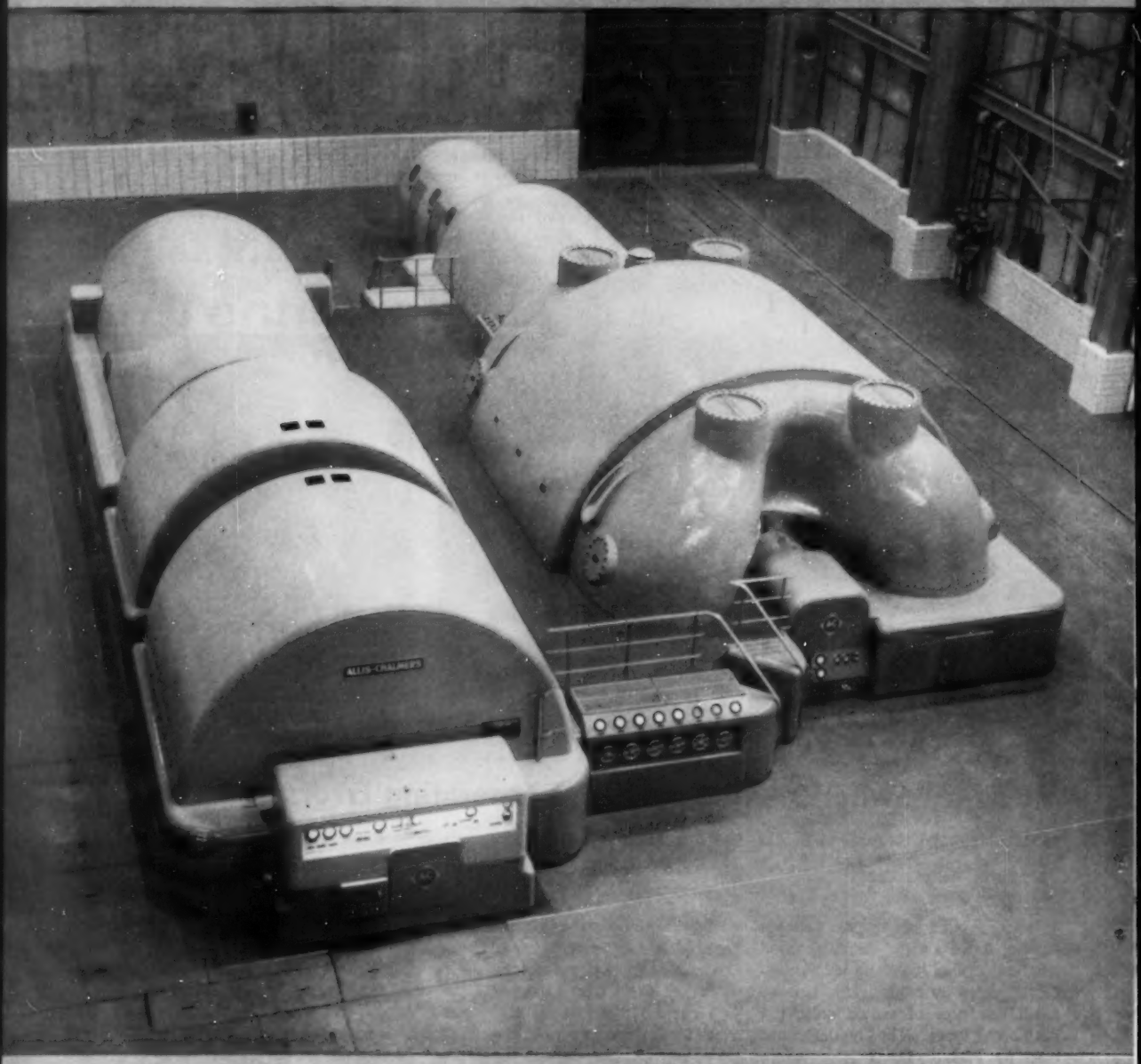
## Service Drop Runs From Pole To Meter

Services on the Kansas Gas and Electric Co system are made as a continuous run from the pole to the meter with service drop cable. Conductors are two No. 4 aluminum with a No. 4 aluminum armor neutral.

Instead of terminating at the build-

(*Continued on page* 142)

# NEW Milestone in




# ALLIS-

# Steam Turbines

## World's first close-coupled, cross-compound reheat turbine completes first year of operation, sets pattern for future power generation.

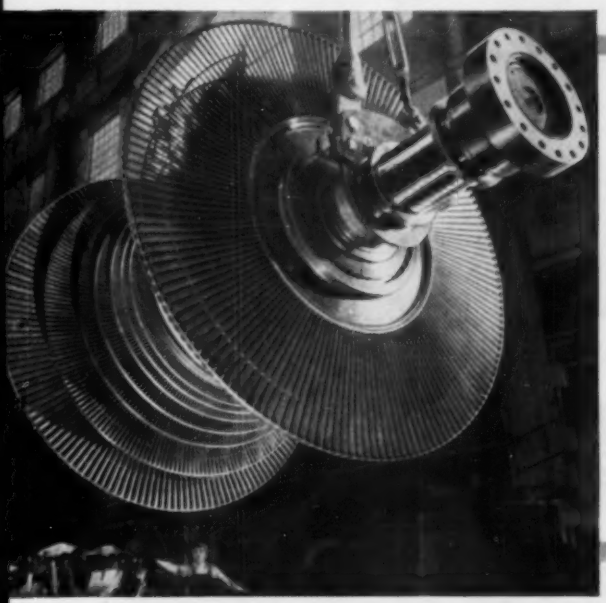
WISCONSIN ELECTRIC POWER COMPANY'S first unit at its new Oak Creek Station has proven design features that open new possibilities for steam turbine development. One additional Allis-Chalmers unit of the same type is being installed, another is under construction.

Close-coupled design makes a compact unit possible. It can be installed transversely or longitudinally in the turbine room with minimum crane span and still stay within space limitations of the boiler. End result is a smaller building with smaller turbine foundation. The entire unit rests on a single foundation. With the shafts so close together, oil piping can be reduced to a single feed and single drain line for both high and low speed machines. Steam piping is short and direct. A short "cross-under" carries steam from the intermediate pressure turbine to the center of the double-flow, low pressure 1800-rpm turbine.

Both high and intermediate pressure turbines operate at 3600 rpm, keeping the high temperature turbines favorably small in physical size. Primary steam to the high pressure turbine is at 1000 F, and reheat steam to the intermediate pressure turbine is also at 1000 F. The 120,000-kw unit generates two-thirds power at 3600 rpm and one-third at 1800 rpm.

You can depend on Allis-Chalmers for pace-setting turbine-generator units engineered to meet your requirements... in ratings up to 500,000 kw. For information, contact your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wis.

A 4451



### Long Exhaust Blades

This cross-compound 3600/1800-rpm reheat turbine provides the large exhaust area needed for superior performance of high capability turbines. Its low pressure turbine operates with 40-inch blades . . . at unusually low ½-inch exhaust pressure. The same low pressure turbine could be used at 1-inch exhaust pressure on a 250-mw unit. In addition, units of this type can be built in sizes up to 500 mw.

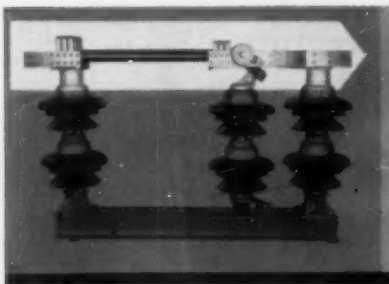
**CHALMERS**

A-C ALLIS-CHALMERS

# USCO AIR-BREAK SWITCHES

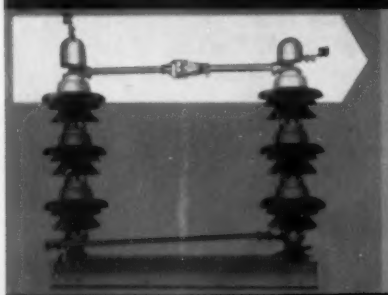
**Official test data and actual field test prove the quality and sound design of USCO high-pressure contact switches!**

These switches are test-proved to have all the desirable features and ability demanded for switchgear today. Compare these general construction features and specific test results. You'll see why USCO air-break switches are outstanding in the field.



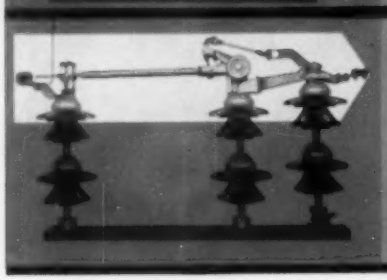
**Official Test Results**
**TYPE G-45**

69 KV — 2000 amperes
79,000 RMS amperes momentary (5 cycle)
67,000 avg. RMS amps, 4-second duration
20° C rise on Heat-run
Available: 15-69KV, 2000-4000 amperes
(69KV, 2000 ampere shown)



**Official Test Results**
**TYPE GCH-1**

69KV—1200 amperes
72,000 RMS amperes momentary (5 cycle)
44,000 avg. RMS amps, 4-second duration
20° C rise on Heat-run
Available: 15-115KV, 400-1200 amperes
(115KV, 600 ampere shown)



**Official Test Results**
**TYPE GT-22**

69KV—1200 amperes
77,200 RMS amperes momentary (5 cycle)
40,000 avg. RMS amps, 4-second duration
24° C rise on Heat-run
(69KV, 1200 ampere shown)

● EASY TO BUY ● EASY TO INSTALL
● EASY TO OPERATE

Your inquiries will receive prompt and courteous attention.
*For full details write to us today.*

USCO

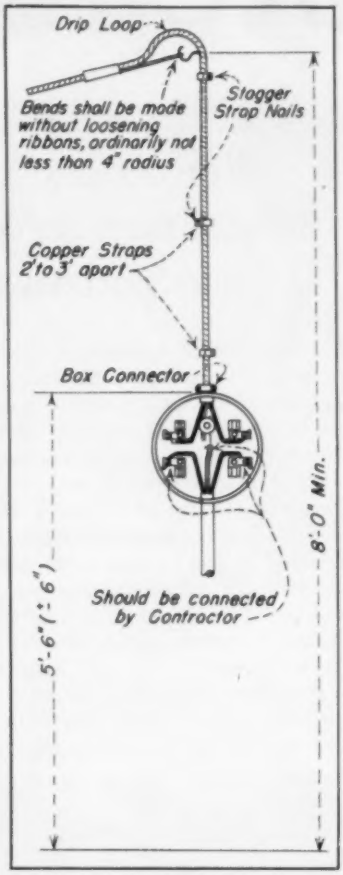
## USCO Power Equipment Corp.

**829 North 36th Way, Birmingham 4, Alabama — Phone 59-7241**

*Designers and manufacturers of high voltage electrical equipment*


## Continuous Service Drop

(*Continued from page* 139)


Drip Loop
Bends shall be made without loosening ribbons, ordinarily not less than 4" radius
Stagger Strap Nails
Copper Straps 2' to 3' apart
Box Connector
8'-0" Min.
5'-6" (± 6")
Should be connected by Contractor

**RUN TO METER is made without connections where cable fastens to wall**

ing and requiring tap connections to the service entrance cable, the service drop cable is anchored at the building as usual but is looped upward to prevent moisture running down the cable and then continued down the wall to the meter. The entire installation is made at minimum cost.

## Spring Keeper Improves Safety in Interrupter Job

**ROBERT CROOKS** and **OSCAR COE**,
Substation Dept, Indiana & Michigan Electric Co, Ft. Wayne, Ind.

A compressed spring keeper improves safety when changing buffer-spring washers and retainers in multi-break oil circuit breaker interrupters.

(*Continued on page* 144)

# Engineers are saying:

## "Lodgepole Pine* appears to be much more ideal for round arm timber application than anything we have tried so far."

* Lodgepole Pine has:

Small knots—no clusters

Strength—slow growth

Uniform taper

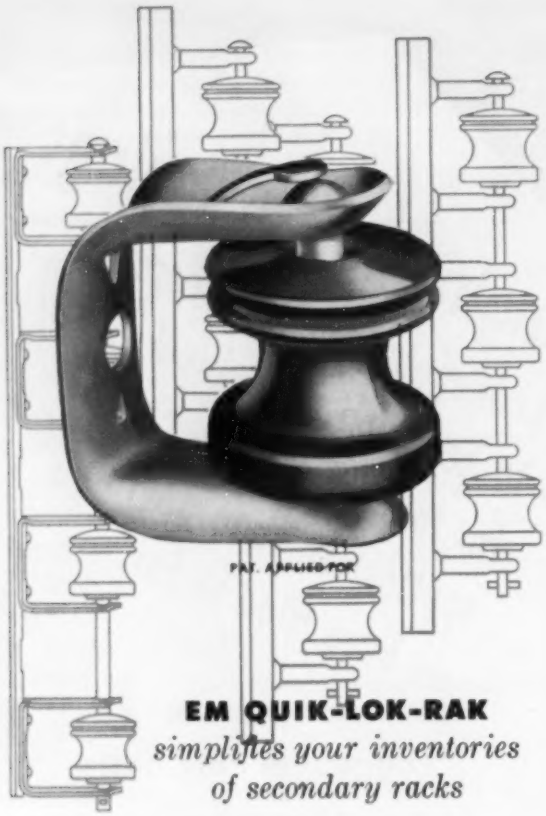
* Penta and creosote-treated Lodgepole Pine crossarms and poles available from our Libby plant. Literature and other information gladly furnished.

J N

**J. Neils Lumber Company**

**Pole Division:** LIBBY, MONTANA

# *Stock this* **ONE** *instead of* **FOUR**




**EM QUIK-LOK-RAK**
*simplifies your inventories of secondary racks*

Why cart around cumbersome stocks of multi-point secondary racks on your line trucks when this one will do the job? In warehouses, too, the No. 699 Quik-Lok-Rak means one item to stock in place of the four you'd otherwise have to handle. It's just good business to simplify your inventory this way, with 699's. In addition to streamlining your stocks, the 699 facilitates installation through use of a cleverly-fashioned metal tab at the top that eliminates the usual cotter key.

Developed by EM in 1946 for a major utility, well over a million 699's are now in service. If you'd like a sample, our comprehensive new catalog, or a call by our representative, a note will get prompt action.

53

EM

ELECTRICAL MANUFACTURING COMPANY • Battle Creek, Michigan

Designers and manufacturers of pole-line hardware that saves you time, money, and maintenance. Prompt action on special problems.


## Spring Keeper

(*Continued from page* 142)

**KEEPER holds springs in the contact assembly of breaker in compression**

The keeper was shaped to hold the bottom springs of the contact assembly in compression while the set screw and center rod are removed.

In the disassembly operation, the contact assembly is placed in a vice. While one man manually compresses the buffer spring, another workman clamps the spring with the keeper so the screw and rod can be safely removed. In the field where a vice is not available, the spring can be compressed by placing the assembly against a column.

The keeper was formed in a U-shape from a piece of ⅜ x ¾ x 11⅞-in. cold-rolled steel and has a 2-in. leg and a 2¾-in. leg.

Formerly, to remove the screw and rod the assembly was placed upright on the floor or bench and a man stood on the mounting ring to compress the spring. Obviously, this procedure is hazardous.

## Scrap Container Unloads Quickly and Safely

Scrap wire containers that empty without inversion are faster and safer to handle than conventional wood or steel containers. The top-loading galvanized-steel containers used by Sacramento (Calif.) Municipal Utility District, were designed and fabricated by district workmen.

The new 30-in. square, 4½-ft deep steel containers are split lengthwise, with hinges joining the two halves at the top. A barrel-bolt-type fastener holds the two sections together at the bottom.

The container is lifted by hooks at each corner of the top side or may be carried by a fork-lift truck. To empty, the container is lifted by a

(*Continued on page* 146)

**A pencil** pokes through this corroded metal! Why chance trouble like this? Cathodic Protection and Anaconda Type CP Cable effectively check corrosion of buried metals.

# CHECK CORROSION by cathodic protection with Anaconda Type CP Cable

Corrosion of buried metals costs industry over a *billion dollars a year!*

But most of this can now be prevented–by Cathodic Protection..

Corrosion–caused by minute electric currents flowing from metal into adjacent soil–is checked by applying direct current from an external source. This eliminates anodic areas, makes the entire metal surface cathodic and stops the flow of current from the metal.

But moisture, oil, acids and alkalies often found in corrosive soil areas are tough on cable.

Because of our many years of experience with buried cable, Anaconda has been able to produce a new Type CP cable – specially designed with double jacket of polyethylene and Densheath* (PVC) – to resist these enemies of cable life. This means less replacement . . . major savings in both labor and material costs.

Would you like more information on how Cathodic Protection checks corrosion?...and detailed information on Anaconda Type CP Cable? Ask the Man from Anaconda – or send for bulletin DM 5450, "Anaconda Cathodic Protection Cable." Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

55340

**ANACONDA®**

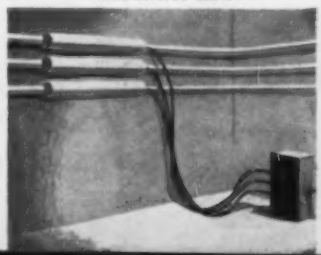
**COPPER AND ALUMINUM WIRE AND CABLE**

* Reg. U. S. Pat. Off.

**Where Anaconda Type CP Cable and Cathodic Protection Cut Corrosion Costs.**

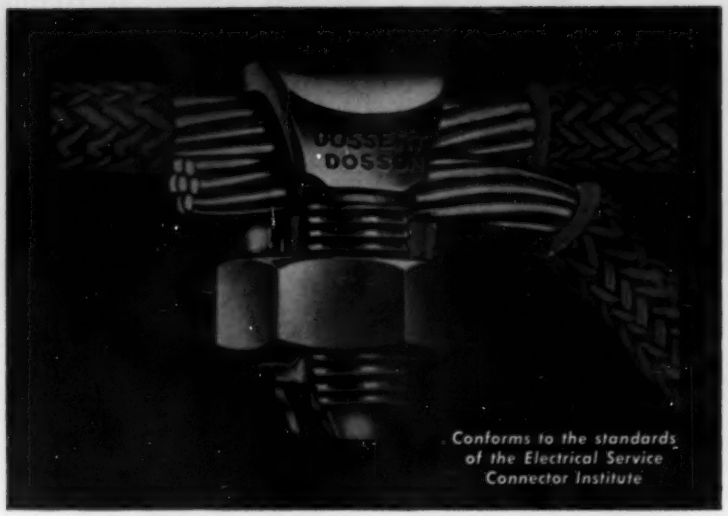
Gas mains and water pipes

Lead-covered cable



Underground storage tanks

Transmission towers




# DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

***Mail coupon for FREE Dosson "F" Connector***

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:
Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

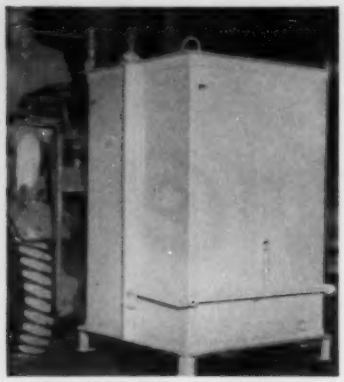
Name _____ Title _____
Company _____
Address _____ Zone _____ State _____
City _____

50 YEARS OF TECHNICAL LEADERSHIP

**DOSSERT MFG. CORP.**
249 Huron St., Brooklyn 22, N. Y.

## Scrap Container

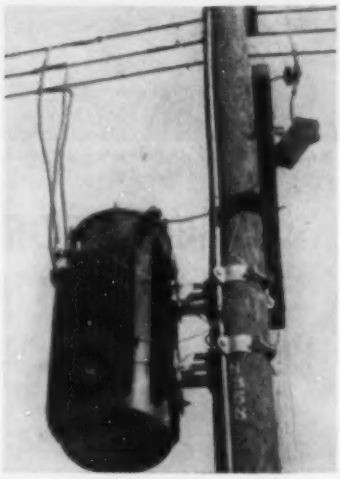
*(Continued from page 144)*



**CONTAINER is split lengthwise with hinges joining halves at top**

crane over the salvage truck. Then the barrel bolt is pulled by a cord to release the fastener. The two halves separate and the load dumps.

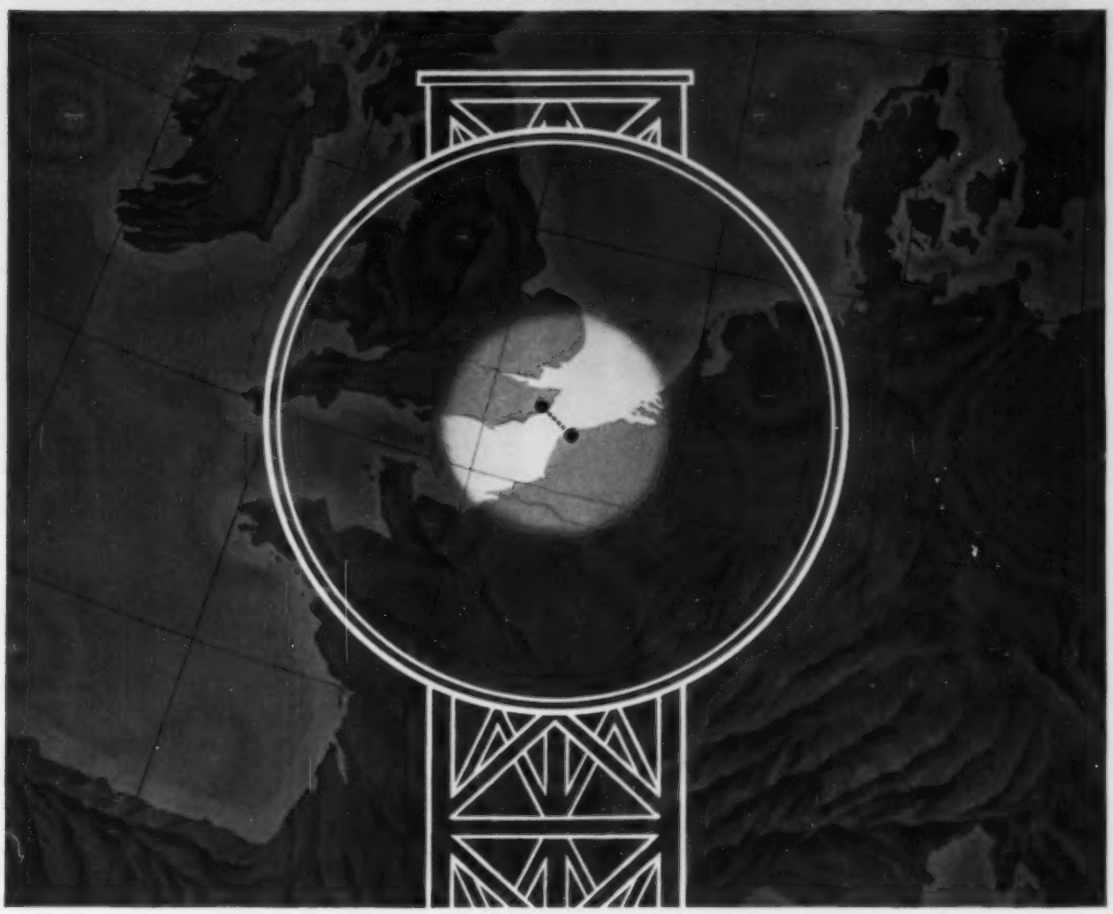
Emptying the wooden crates previously used was a slow and hazardous job because they had to be carried, lifted, and unloaded manually.



## Bracket Holds Large Single-Phase Transformer

Brackets designed for mounting three, single-phase transformers in banks have been used effectively by Kansas City Power & Light Co to mount large transformers for single-phase service. This type of installation eliminates the crossarms previously used for installing the large transformers. It places all the weight on the pole and avoids cluttering the pole.

## FEDERAL MICROWAVE—"CERTIFIED BY A WORLD OF RESEARCH"



# "Hello, Calais, this is Dover calling!"

Nearly a quarter of a century ago the world's *first* public demonstration of microwave communication took place across the English Channel, when scientists of International Telephone and Telegraph Corporation established telephone and teleprinter service between Calais, France, and Dover, England.

Out of this historic experiment IT&T developed the world's *first commercial microwave link*... the techniques and processes that resulted in one major "first" after another... in multichannel relay systems, television links, multiplex broadcasting, and diplexing.

Today, through *Federal* Microwave, private companies and administrations can draw upon IT&T's unique record in microwave pioneering... its still expanding pool of world-wide experience in research, engineering, manufacturing and system operation.

*Federal* can supply all microwave needs from under one roof... links and networks of any channel capacity ...also associated telephone, carrier, and VHF mobile radio equipment... every facility for a complete, smooth-working system..."*Certified by a World of Research!*"

Federal

A DIVISION OF IT&T

**Federal Telephone and Radio Company**

*A Division of* INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

100 KINGSLAND ROAD • CLIFTON, NEW JERSEY

*In Canada:* Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P.Q.
*Export Distributors:* International Standard Electric Corp., 67 Broad St., New York

Filling stations . . .

Plant offices . . .

# Your Best Bet for

## Space heating—heat pump or resistance—on commercial-industrial jobs has

**S. S. SANSBURY**, Sales Development & Training, Union Electric Company of Missouri, St Louis

To utilities where air conditioning loads are establishing summer peaks, the heating load—particularly in commercial and industrial fields—warrants intensive development.

There are some striking factors that make both the heat pump and resistance space heating more competitive in these markets than in the home. For the heat pump there are these:

- In many types of commercial and industrial operations the heat gain is nearly equal to or exceeds the heat loss.
- Zoning is of greater importance than in the home.
- Heating and cooling may be necessary during the same day, sometimes even at the same time.
- Dollar savings by elimination of stacks, flues, boiler rooms are of greater magnitude than in the home.
- Opportunities may exist for using waste from a plant's process operations.
- Free throw units may frequently be used.
- Multiple-story structures of certain sizes may find advantage in floor by floor heat pump installations.
- Small, multiple-unit commercial buildings can utilize individual heating and air conditioning in each store with the tenant paying for the service instead of the building's owner.

**Heat Pump Installations . . .** Some of these advantages are shown in installations made in Union Electric's area. Water source heat pumps, one of 20-ton and the other 15-ton capacity, were put in service in two offices of Citizens Electric Corp, customers of Union Electric. Duct-type resistance units were installed in each system as insurance against water trouble. This type of installation is gaining favor for straight commercial and industrial space heating applications in connection with air conditioning systems because of its low initial cost, approximately $200 per 100,000 Btu.

A new office building of the National Farm Equipment Association, now nearing completion in St. Louis, will be air conditioned and heated by eight air source heat pumps. The cost, including duct work, was just under $25,000. Architects figure that with the savings in cost of stack and oil storage, the heat pump's cost is less than that of oil heating and conventional air conditioning.

In most of Union Electric's area there is not much opportunity for water source heat pumps because of the extremely deep water table.

**Resistance Heating Advantages . . .** There are plus factors for electric resistance heating, too, that place it in more favorable competitive position for commercial and industrial applications than for home heating. Among these are:

- Space saving is of more significance.
- Safety means more in many installations.
- Opportunity for control of night and weekend setback, combined with electric heating's ability to pickup quickly, helps make operating costs competitive.
- Low initial cost becomes even more important, as the installations become larger.
- Cleanliness, and economics in maintenance and labor offer savings of greater magnitude than in the home.
- Employee comfort.

Several types of commercial-industrial space heating loads are being secured in our territory. Some examples:

Drive-in theatres, and . . .

Motels are . . .

# Electric Heating Sales

## advantages to both consumer and utility not found in residential field

**Filling Stations and Motels . . .** Seven units in the Clark Filling Station chain are electrically heated as will be all its stations built in the future. Safety and savings in space are Clark's reasons. Adoption of electric space heating at a local motel also resulted in installation of electric water heating and the equipping of its restaurant with commercial electric cooking units. Results have been so satisfactory that the owners put in similar equipment in another motel recently completed.

**Drive-In Theaters . . .** By providing electric heating for autos, drive-in theaters are fast becoming year-round businesses. Bel Air Drive-In Theatre, first to go to electric heat in the St. Louis area, also installed some 40 kw of electric cooking in its refreshment stand. The past year's results have been so good, that the owners have begun construction of a 1,000 car drive-in to be equipped with 500 car heaters, plus an air-conditioned concession building with a four-line cafeteria and 100-kw in short-order equipment.

Average food tab per person at the present theatre is 38¢ as compared with the admission price of 65¢. The management expects in the new larger theatre to boost this average to equal the admission price level.

The present Bel Air operation, now with a max demand of 120 kw, uses some 15,000 kwh per month during the summer and 14,000 to 18,000 kwh a month during the winter. Demand for this load averages 130 kw of demand from 5:30 pm to 11:30 pm; 12 kw for the remaining hours of the day.

**Plant Offices . . .** Relationship of the heating load to the customer's total load and system load were turned up in a study Union Electric made of 59-1,000-w glass heating panels installed in offices of a local manufacturing plant. Installation was made in 1953 when the office area was expanded to its present 5,500 sq ft (47,770 cu ft). First thought was to use natural gas which already was being used in the manufacturing section of the plant.

But investigation of electric heat showed it not only would be economical, but would save space and time as well. Sorely-needed space being occupied by the boiler room could be used for manufacturing purposes, and several manhours per day needed for checking on boiler startup could be eliminated.

Building is of concrete construction, and the large window area in the electrically-heated office section is equipped with storm-sashes. Installation was submetered from October through March, 1953-54. By extending the submeter data on the basis of a normal winter's degree days, we found that:

- The 59 kw of electric heating panels established a max non-coincident demand of 50.88 kw and coincident demand max of 27.6 kw.
- Normal winter season consumption amounts to 23,429 kwh, which at an incremental rate of 1.81¢ per kwh, amounts to $8.89 per season per 1,000 cu ft of heated space. Putting it another way, it amounts to 0.107 kwh per degree day per 1,000 cu ft of heated space.
- In a typical day, max demand after 30 min of operation drops from 50 kw to 39 kw (load comes on at 6:30 a.m., and goes off at 6 p.m.). By 8:30 a.m. it drops to 20 kw and holds at or below this point until automatically shut off.
- System peak on a typical day occurred at a time when demand on plant's heating was only 20% of its max.

# How They Use Electricity To Save:

OUT-OF-THE-WAY capacitors connected to the plant's distribution system raised the power factor above 85% lagging

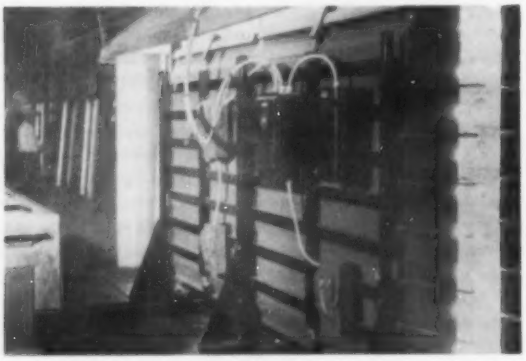
## • MONEY. A $5,000 capacitor bank cuts power bill $13,200 yearly

C. D. ANDERSON, Power Sales Engineer, Savannah Electric & Power Co, Savannah, Ga.

A $5,000 installation of 40-7½-kvar capacitor units at the Southern Cotton Oil Co, Savannah, Ga., has saved the customer $13,200 in one year on the 70% demand charge penalty. It also improved voltage conditions on the plant's distribution system, said W. S. Lovell, plant engineer.

This plant had a hydrogen generating plant with accompanying d-c synchronous converters, resulting in a high power factor to the utility. When this process was discontinued in favor of more modern methods, an agreement was worked out whereby the customer would not be penalized because of the reduction of demand if sufficient capacitors were installed to bring the power factor back above 85% lagging. Capacitors were put in the plant on the load side of overcurrent devices and in banks.

HARRY F. MOORE, Industrial Representative, Pennsylvania Power & Light Co., Williamsport, Pa.



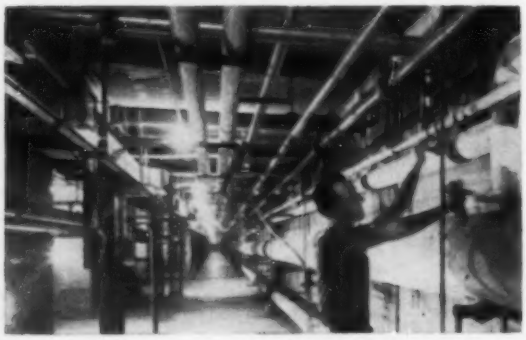
THIS INFRARED DEGREASER has these advantages beyond its space economy: quick heat, low maintenance, no fuel storage

## • SPACE. Compact infrared oven fills smaller area, needs fewer men

A 174-kw infrared degreaser has yielded a space saving, permitted better painting of steel boiler jacket parts, cut the handling of parts considerably and freed two men for other work for Radiant Steel Products Co, Williamsport, Pa.

The parts formerly were degreased at night in a gas-fired vapor-type degreaser. This necessitated much handling and storage. Furthermore the vapor degreaser could not be used while other parts were being spray-painted because the grease fumes ruined the paint finish.

The infrared oven consists of 288 lamps rated at 375 w, and 264 lamps rated at 250 w. Parts are hung from an overhead conveyor which carries them through the infrared oven to the paint spray booth, then through the paint-drying oven.



## • TIME. Easy-to-get-at bus ducts let workmen tap power quickly

Hung in tunnels under the floor of the new Lily-Tulip plant, Springfield, Mo., 2,000 ft of 600-amp bus-duct make 208-v, 3-phase power available to 1,500 motors. Quick and economical installation permits any motor to be plugged in on 24-in. centers. Tunnels, which are 9-ft wide and vary in width from 5 to 14 ft, also convey such services as water, gas, steam, steam condensate, vacuum and liquid paraffin. By making the services easily available, maintenance costs are cut.

(*More Industrials on page* 152)

# ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

## YOU WANT

- *EXTRA FATIGUE RESISTANCE,*

## PLUS

- *LOWEST LONG-TIME CREEP RATE,*
- *HIGH BURSTING STRENGTH,*
- *TOP STABILITY UNDER HEAT,*
- *ABOLITION OF FREQUENT STOP JOINTS OR REINFORCED LEAD SHEATH,*
- *ABOLITION OF NEED FOR GENEROUS EXPANSION BENDS OR LARGE MANHOLES...*
- *THE DEPENDABILITY ASSURED BY OUR EXCLUSIVE MANUFACTURING, TESTING AND FIELD EXPERIENCE...*

*IN SHORT,*

## YOU WANT

# ROEBLING

*Subsidiary of The Colorado Fuel and Iron Corporation*

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 924 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 221 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

# Crapo
GALVANIZED STEEL
## STRAND

**Strong...**
to support pole structures under adverse ice and wind loadings.

**Rugged...**
to withstand the punishment incurred in construction and service.

**Long-Life...**
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

**-and Economical, Too!**

● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

**REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS**

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

**Contact your jobber of *Crapo* Galvanized Products or write direct for further information!**

**INDIANA**
STEEL & WIRE COMPANY
MUNCIE, INDIANA

**REFRIGERATING DAIRY PRODUCTS overnight in these preloaded delivery trucks is assured by outdoor distribution system which supplies 220 v to 51 vehicles**

## "Electric Parking Lot" Keeps Milk Cold

- **Summer heat no problem at night**
- **Trucks start deliveries early next day**

Outdoor circuit breakers that switch 220 v are being used at the Menands, N. Y., milk plant of the Borden Co to keep individual refrigeration units running when loaded delivery trucks are parked overnight.

Upon returning after a day's work, the driver has his truck reloaded for the next day. Then he parks in one of 51 spaces allotted to delivery trucks in the outdoor lot. He plugs in his truck. Running on 220 v, the refrigeration unit in the truck maintains dairy products at 40F.

Interlocking circuit breakers and plug-receptacles are used because of several safety advantages:

They protect personnel using them in wet weather. An additional contact is provided in the receptacle and plug for connecting the grounding connector in the portable cable.

The breakers have an interlocking plug-receptacle with a spring-door housing at the breaker's bottom. The receptacle is so interlocked that the plug cannot be inserted or withdrawn unless the breaker is off. The breaker cannot be closed unless the plug is fully inserted.—Crouse-Hinds Co, Syracuse, N. Y.

**INTERLOCKS on circuit breakers prevent plug's removal when power is on**

## 2 Pushbuttons Spell Safety

A two-pushbutton control has been developed for electric machinery, particularly printing presses. Both buttons must be depressed before the machine will continue to run. When either button is pressed singly, the machine starts rapidly. It stops immediately when the button is released. This permits the operator to "inch" his machine, while making adjustments without danger of its continuing to run. The device was developed by Harris-Seybold Co, and Cutler-Hammer, Inc, Cleveland, Ohio.

(*Industrial Briefs on page* 154)

There's always a CHANCE for a better connection . . .

# AGP* proved best by test for joining aluminum and copper conductors

Chance AGP Clamps, approved by power company after power company *on the basis of their own tests,* can be used for all types of connections: copper to copper, copper to aluminum, aluminum to aluminum, and aluminum to copper.

Chance FORTIFIED cadmium coating, applied .001" thick to the aluminum body of the clamp, resists corrosion and electrolysis in all types of connections. This high density FORTIFIED cadmium coating gives extra long life protection to both the clamp and the conductor.

AGP tap clamps have the advantage of light weight which lengthens conductor life by minimizing the effects of vibration and makes them easy to handle on a clamp stick . . . plus easy identification with the RED EYE SCREW—plus their most important feature, their versatility. You can reduce your inventory and greatly simplify your stocks by standardizing on AGP.

* Aluminum General Purpose

**Chance "P.C." (Protected Connection) Clamps**

Complete thread protection for easy installation and removal. No threads are ever exposed except in the extreme opened position. Wide jaws contact all strands.

**Chance Perma-Grip Tap Clamps**

Here's a service-proved tap clamp for all general applications. Gripping jaws of this clamp make a three-point contact with conductor.

**Chance AGP Parallel Groove Clamps**

Here's a Parallel Groove Clamp for all conductor combinations that doesn't need an insert and can't be put on wrong. Either side will take copper or aluminum and give you the best parallel groove clamp connection you can get. The wide jaws of this clamp contact every strand of the conductor making a positive, high conductivity connection.

Each size covers a wide conductor range.

Micro-photo below compares Chance A.G.P. fortified cadmium coating (left) to commercial plating, one reason for A.G.P.'s success. Get the full story.

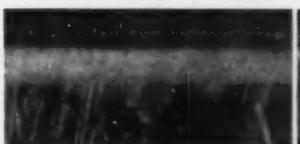
**Chance z.i.n. 100— Electrical Contact Sealing Paste**

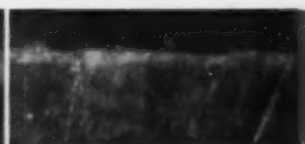
For use with hot line clamps, bolted and compression type connectors.

**1.** Protects any bi-metal combination against corrosion and **2.** Improves conductivity. **3.** Z.I.n. 100 is waterproof and stays plastic. **4.** Will not melt under 340° and **5.** Can be "worked" at 25° below zero. **6.** Non-toxic. **7.** Non-inflammable. Available in 5 fluid oz. tubes or 1 qt. cans.

Application brush available for hand use or hot stick.

CC55-6





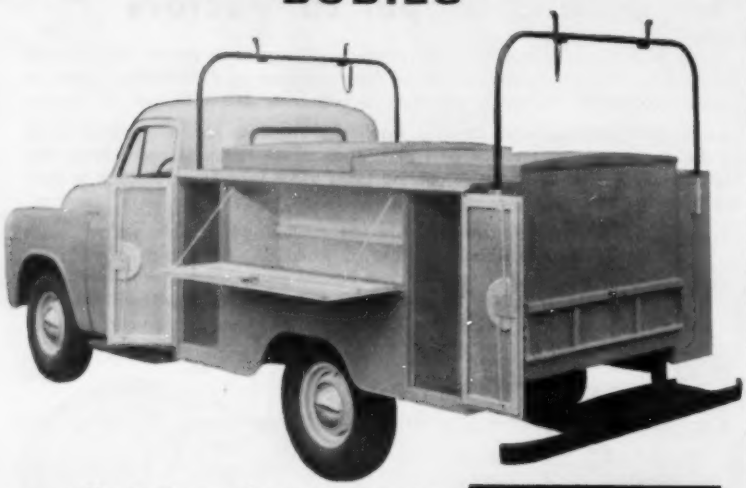
A·B·CHANCE CO·

CENTRALIA, MISSOURI

San Francisco, Cal.

Completely NEW . . . for Electric Utilities

# Meter Installation and General Service BODIES



**@Morrison's new electric utility Service Bodies and Accessories give your trucks a clean, neat appearance . . . provide maximum safety for crew and equipment . . . feature a compact design with more useable carrying space and a time-saving accessibility to tools, parts and supplies.**

There is a Morrison Service Body to fit any ½ - ¾ - 1 and 1½-ton, single or dual wheel chassis. With more than 20 new design and construction features, Morrison Service Bodies are engineered and built to meet the specific requirements of electric utilities, in accordance with their recommended specifications.

Morrison Service Bodies and Accessories can completely equip any truck for any job. For meter installation and service there are Meter Trays for both horizontal and vertical compartments. They are equipped with necessary padding and hold-down straps which clamp the meter securely in place without sacrificing easy access for loading and unloading. Other available optional equipment includes material bins, rope hooks, rear bumper step and sliding top with lockable rear closure. For general service work, either overhead ladder bows or side mount ladder brackets can be installed.

In all phases of utility service work, Morrison Service Bodies and Accessories can help you promote crew efficiency and cut operating costs. Complete information on the entire line is available on request.

**For Better Service and Greater Utility . . . Specify**

# Morrison service bodies

*Morrison Service Body Division*

**MORRISON STEEL PRODUCTS, INC. • 695 Amherst St. • Buffalo 7, N. Y.**

*Morrison Service Bodies are stocked locally in more than 60 strategic locations*

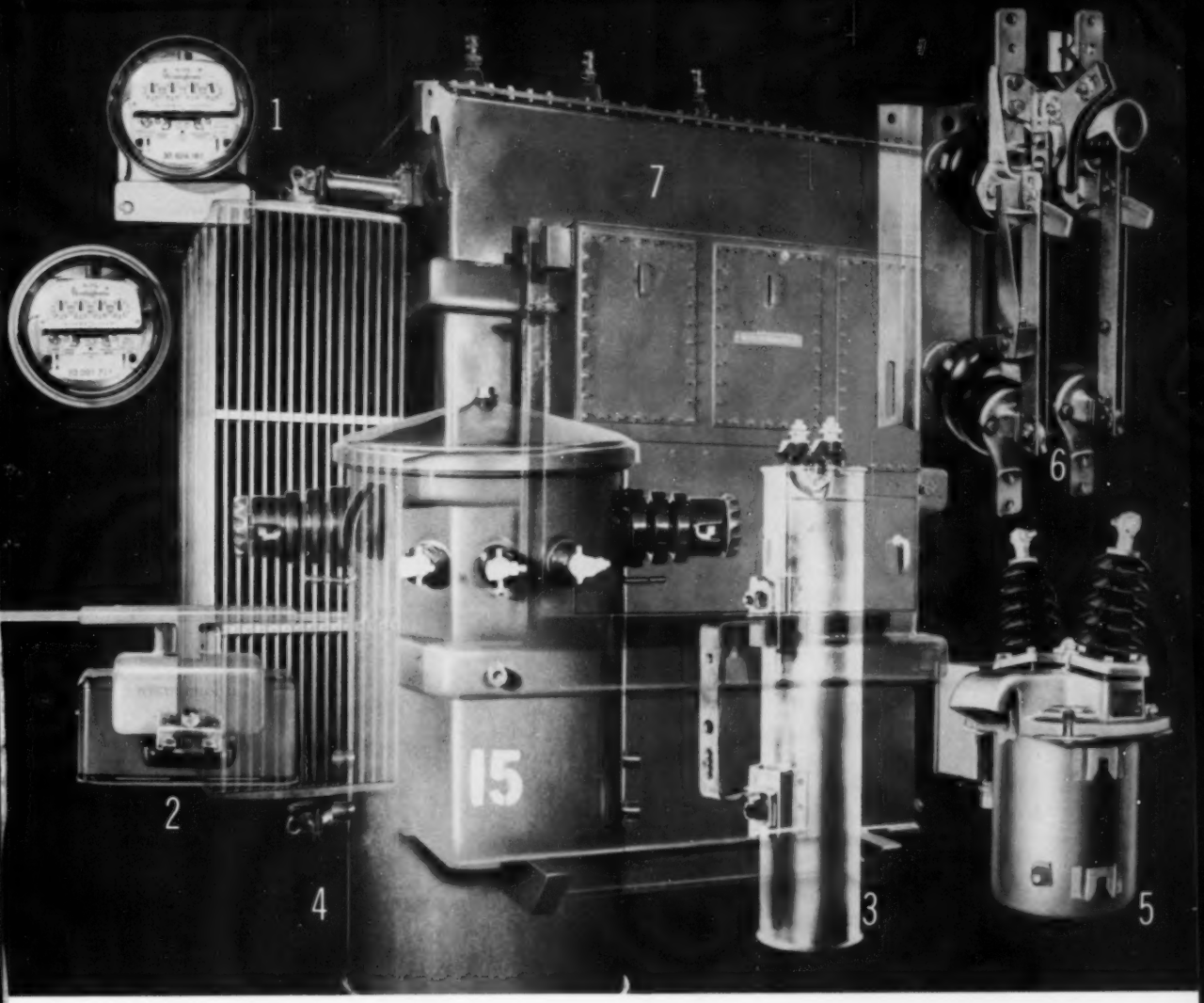

## INDUSTRIAL BRIEFS

**Converting 240-v** distribution system to 480 v has enabled Bridgeman-Russell Dairy, a division of Foremost Dairy in Duluth, Minn., to continue using its main air circuit breaker, which had reached its capacity at 240 v. The conversion was made while the company was adding a 75-hp and a 50-hp compressor motor to its already-overloaded distribution network. As a result, total amperage and line losses dropped, and extra capacity was created to absorb future demands. At the same time, the company replaced its antiquated electrical switchboard with a modern panel. This saved space and improved safety conditions. Fred E. Stout, Industrial Sales Engineer, Minnesota Power & Light Co, Duluth.

**Packaging meat** in a wrapping of fat to enhance the eye- and taste-appeal of cheaper cuts is being done electrically in 30 min by a machine that replaces one man's work for 8 hr. It prevents discoloration and shrinkage, and aids in basting. Fed through a meat grinder, fat is extruded through the electric larding machine onto sheets of cellophane or parchment paper. Controlled heat in the extruding jaws fuses the fat into a sheet that can be easily cut. These machines, made by Needham Mfg Co, Needham Heights, Mass., are used largely in the East by groceries such as A&P Stores. National Electrical Manufacturers Assn.

**Relighting** the general accounting office of Dravo Corp, Neville Island, Pa., from 95 to 110 ft-c at desk level has been credited with raising employee morale and reducing errors. Seven banks of fluorescent fixtures were put over five rows of desks. Formerly 5-ft tubes in industrial type fixtures lit the office. But to cut glare, improve quality and enable management to install an attractive acoustical ceiling, these were replaced with fixtures using two 40-w lamps. Fixtures are arranged so that a third lamp may be added to each when needed. Although it has not been estimated how much office production increased, studies in other relighted offices showed production jumps as high as 6%. K. P. Allen, Industrial Salesman, Duquesne Light Co, Pittsburgh, Pa.

(*More Industrials on page* 167)



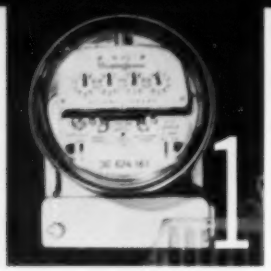
# 7 new products...7 new solutions to distribution problems

Today, one of the most important areas of utility operation is distribution. A constant stream of new ideas and new developments is needed to help solve the problems arising from ever-increasing loads—ever-greater system demands.

Here, L. L. Wrentmore, Westinghouse Distribution Apparatus Manager, presents seven new products that represent the solution to many of these problems.

YOU CAN BE **SURE**...IF IT'S

**Westinghouse**

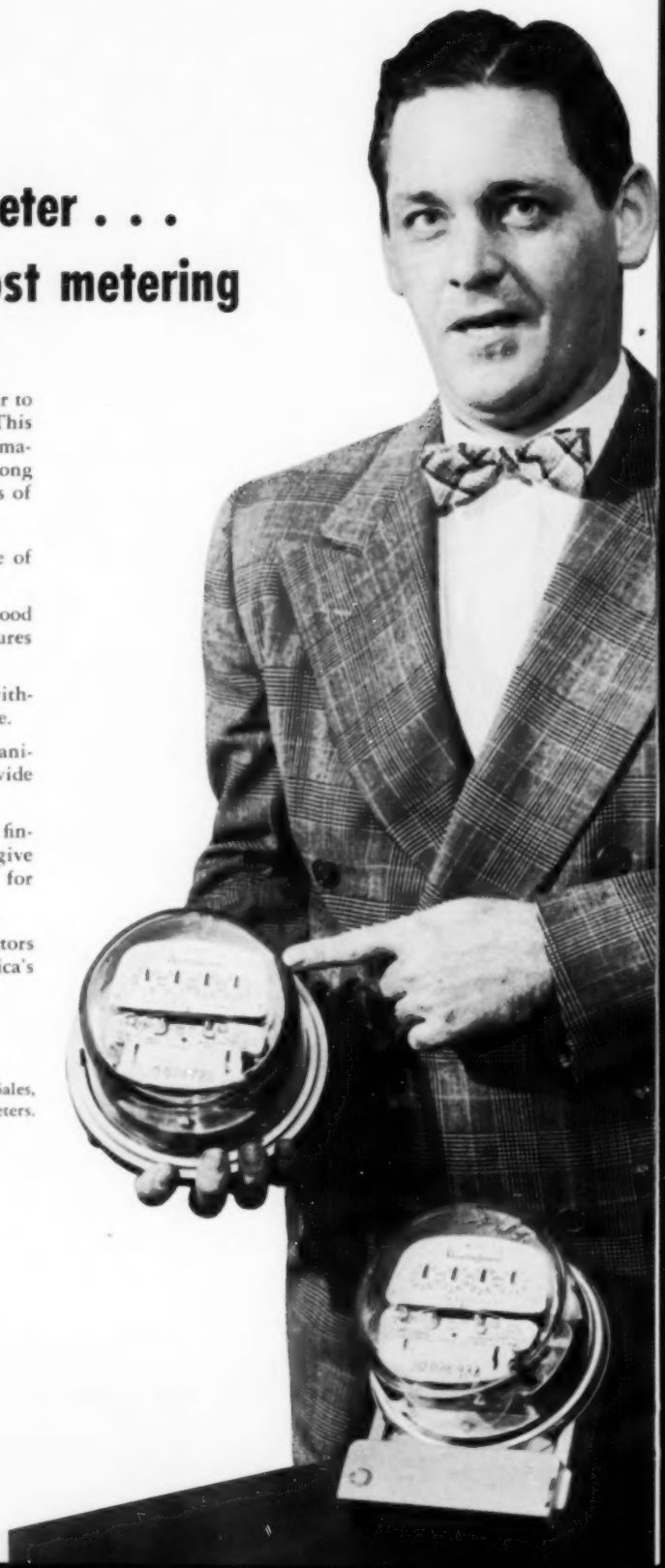


# New *Lifetime* meter . . . for long life, low-cost metering

Westinghouse has designed the Lifetime meter to measure all foreseeable single-phase loads. This new meter design has coordinated the latest materials and processes to assure you of accurate, long life, low-cost metering. The five basic factors of economic metering are:

1. **Range**—Sufficient load range to take care of present and future loads.
2. **Thermal Capacity**—The ability to give good service and long life at extreme temperatures and high overloads.
3. **High Insulation Level**—The ability to withstand high-voltage surges without damage.
4. **Stability**—Meter is inherently stable mechanically, electrically and magnetically to provide long-time accuracy.
5. **Corrosion Protection**—All materials and finishes are selected and coordinated to give maximum protection against corrosion for long life and low maintenance.

The new Lifetime meter gives you *all five* factors to answer your needs in measuring "America's greatest bargain"—economically.



**R. A. Warren,** Manager of Meter Sales, with the new Lifetime DS & DA meters.

**Bob Hurst**, Sales Manager, Instrument Transformers, shows new molded construction of the SM-5 transformer.

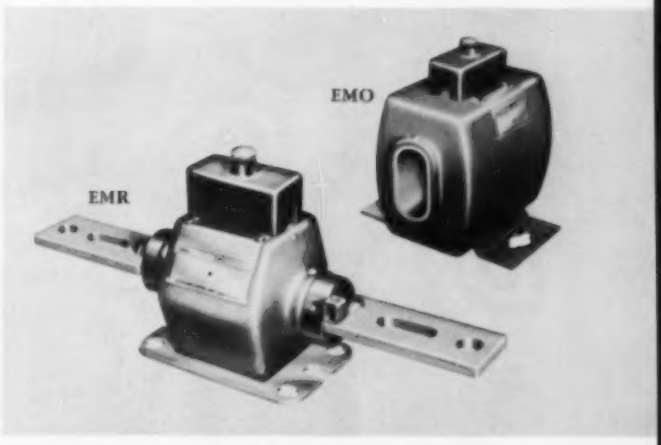
# New instrument transformers . . . molded design improves performance, extends life

Westinghouse instrument transformers, types SM-5, EMR and EMO, have been designed with new molded construction for greater thermal and dielectric stability, better accuracy and longer life.

The SM-5 is a 5-kv indoor current transformer which is silicone insulated throughout. It is smaller, lighter, yet more durable than any similar unit.

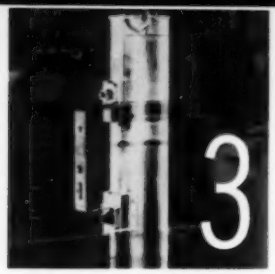
Types EMR and EMO are outdoor-indoor current transformers for 600-volt service. The EMR is a miniature unit featuring a round primary opening with or without removable primary terminals. The EMO features an obround primary opening for use with multi-cable primaries. Both are molded with a new polyester elastomer insulating material that is more weather resistant than any material ever used for this purpose.

All three offer complete installation flexibility and may be adapted to virtually any type of mounting. They are in stock, ready for prompt delivery and long, dependable service.



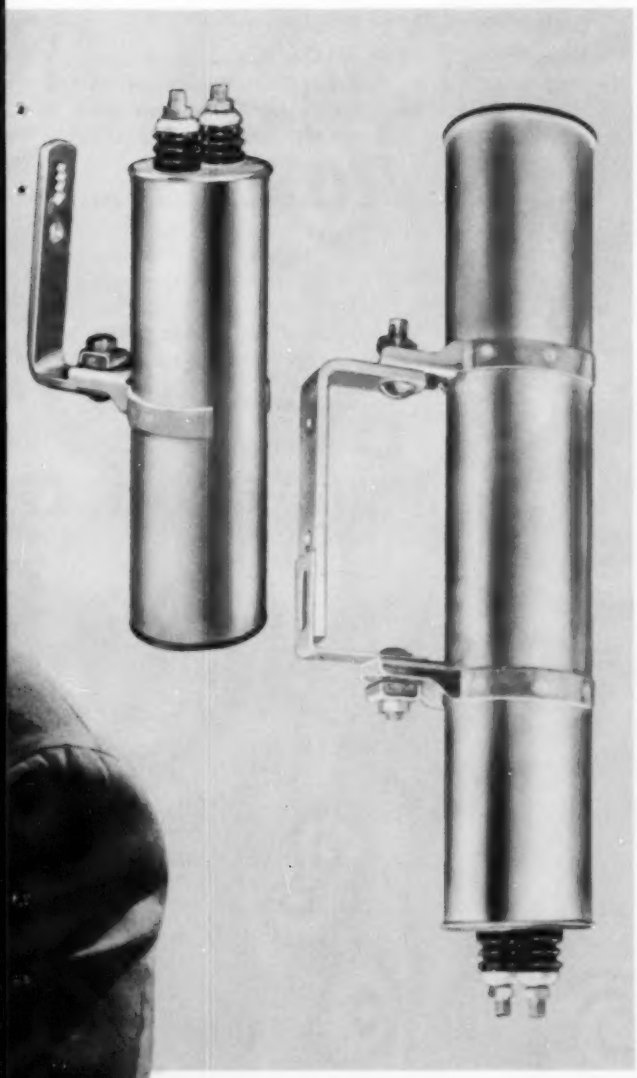

**Types EMR and EMO** current transformers for 600-volt service.

YOU CAN BE SURE...IF IT'S Westinghouse




**Ralph Marbury,** Manager of Capacitor Engineering, with the new 7½-kvar capacitor.

# New 7½-kvar capacitor...lower cost kilovars



The rapid increase of inductive loads on secondary circuits is creating problems of low voltage and overloaded transformers.

Under these conditions, Westinghouse can give you an important assist with secondary capacitors, at appreciably less cost than with other methods. Utility studies show capacitor costs are often ½ to ⅔ the cost of transformer capacity released for new load.

Let's take a closer look. Specifically for relief of transformers, these capacitors can:

1. **Release transformer capacity**
2. **Reduce secondary line losses**
3. **Improve voltage**

The new 7½-kvar, 240-v capacitor now joins the 3 and 5-kvar units to give you a complete line of Westinghouse secondary capacitors. They offer low original cost, with reduced installation and maintenance expense. They have 16-gauge extruded aluminum tubular cases and weigh 40% less than competitive units. One man can carry these units up a pole and install them in a few minutes. The case will never rust or need painting. Silicone-rubber bushing gaskets are impervious to Inerteen®, and are not affected by extreme temperature changes.

Westinghouse developed the 7½-kvar capacitor for higher rated transformers. The length of this unit is the same as the 5 kvar and only slightly larger in diameter. Two 7½-kvar capacitors, for example, now service a 37½-kva transformer, replacing four 3-kvar or three 5-kvar units. Extending the economies of capacitors, you now have fewer to hang—new savings in cost per kilovar.

**The Westinghouse proved-in-service, 3 and 5-kvar capacitors** can be mounted with bushings either up or down, bolted to the pole or mounted on the crossarm with a standard EEI-NEMA bracket.

YOU CAN BE SURE...IF IT'S Westinghouse

# New distribution transformers . . . from smallest to largest ratings

Here's a new standard for transformer dependability: the new Westinghouse pole-type distribution transformer, *completely* redesigned in all ratings from 3 to 167 kva.

This is the transformer *you* helped design. As a result it has the features you want—solves the problems that plague you in the field. For instance . . .

**Corrosion**—The new design eliminates all water-collecting surfaces, moisture-entrapping seams and crevices, corrosion-vulnerable hardware. How? Through the dome cover with its unique single retaining bolt, internally clamped bushings, projection-welded hanger lugs, rolled tank bottom and exclusive 3-coat Coastal Finish.

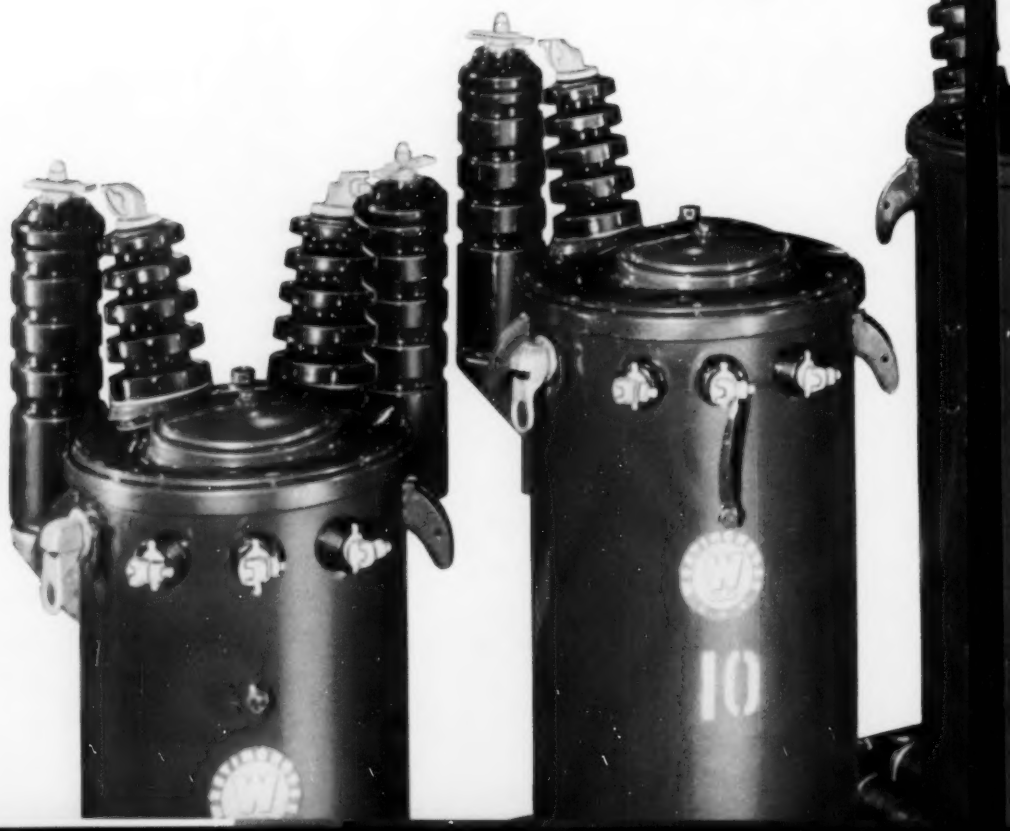
**Sealing**—Corprene gaskets on both bushings and cover are sealed and retained. The dome cover design actually increases gasket pressure 250%.

**Installation**—Reduced height of wall-mounted bushing designs, 25 to 50 kva, permits change-outs to higher ratings on existing poles. The new tap changing device is fast, easily accessible. Bushing terminals take either copper or aluminum.

**Operation & Maintenance**—These are some of the features that make for better operation and easier maintenance: redesigned core and coil, improved core gap processing, ValvEX arresters, single cap bolt and wrap-around end frame.

Yes, for every problem there's an answer in this Westinghouse transformer. Feature for feature, dollar for dollar, there's nothing to equal it.

YOU CAN BE SURE...IF IT'S Westinghouse



# . completely redesigned inside and out . . .

**R. N. McCollom,** Sales Manager, Transformer Division, shown with production line of redesigned transformers.

**Bob Lawrence,** Distribution Apparatus Product Engineer, points out the application of the LP switch.

# New LP switch solves "cold load" pickup problem

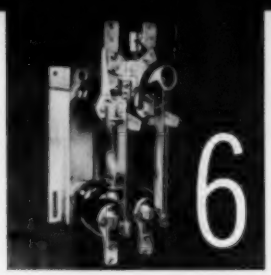
Write off another distribution headache—picking up an urban or suburban circuit following an outage.

The new Westinghouse load pickup switch substitutes automatic load shedding and restoring for the undesirable practice of relay blocking or manual line sectionalizing.

The LP is a 200-ampere switch suitable for all voltages, 2.3 to 15 kv. It automatically sheds the load it controls following a 2-minute loss in system voltage, closes to pick up that load with adjustable time delay of up to 5 minutes following restoration of voltage. Properly located, a set of LP's will shed $\frac{1}{3}$ to $\frac{1}{2}$ of the load on a distribution feeder breaker, allowing it to pick up the load in easily handled increments.

The advantages? Eliminates costly manual sectionalizing of faulted circuits, giving fast, positive restoration of service. Permits lower relay settings on breakers, resulting in improved fault sensitivity and less chance of conductor burn-down.

The steady growth of loads and the greater use of automatically controlled appliances point up the importance of this new Westinghouse development.



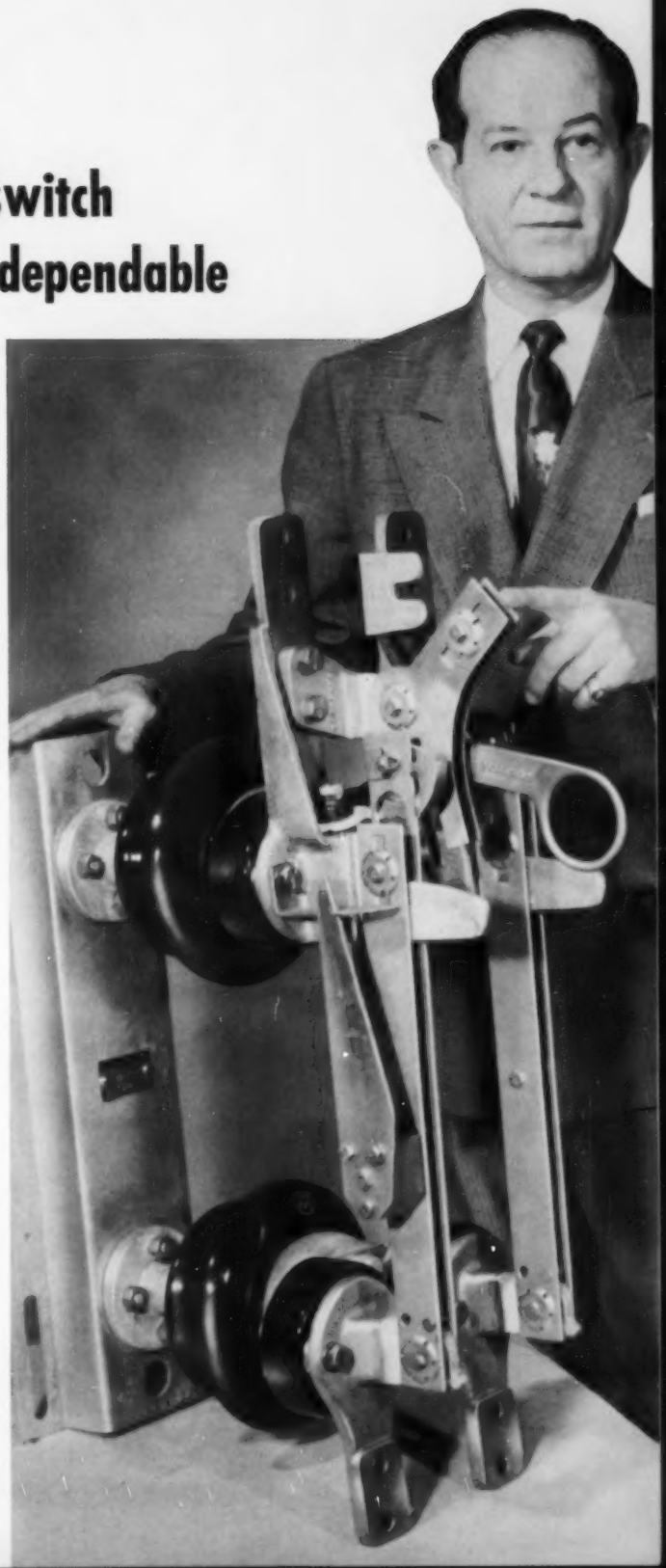
6

# New regulator bypass switch simpler, sturdier, more dependable

The new Westinghouse RBO switch has all the features that have made the LCO line of outdoor switches so successful for years. Multiple-line contacts on the main blades are silver-to-silver, high-pressure type which will carry full capacity yet open easily. Double-blade construction provides increased contact pressure under short-circuit conditions because magnetic action draws blades together. The switch is sturdily constructed throughout, using annular ring hinge contact, bent-plate steel base and extra-large hook eye.

There is no possibility of operator error with the new Westinghouse type RBO regulator bypass switch because proper switching sequence is built in and is automatic. The mechanical arrangement between the main blades and the bypassing blades insures proper sequence of operation. Since there is but one hookstick-operated eye for isolating or restoring the voltage regulator, there is no question as to which switch to pull first.

The new switch is recommended for bypassing regulators because it prevents costly errors. As an extra dividend, however, it also will save space, reduce structure size, economize on construction and installation costs, reduce conductor length and simplify connections.



**Wilbur Pyle,** Sales Manager, Switchgear Devices, points to the bypass blade arrangement of the new RBO switch.

YOU CAN BE SURE...IF IT'S

Westinghouse

J. C. Rissinger, Manager of Small Power and Equipment Transformer Sales, points to Westinghouse mobile substation.

# Mobile substation . . . key to a

Westinghouse mobile substations like this make possible a new look in distribution substation design. With a completely mobile substation available to carry the load during routine maintenance outages, it becomes entirely practical to combine the usual substation equipment into a package design with resultant higher efficiency, lower installation costs and reduced maintenance. As an example, single-phase transformers with separate regulators can be replaced by standardized 3-phase transformers with integral tap changing underload or "CSP®" power transformers.

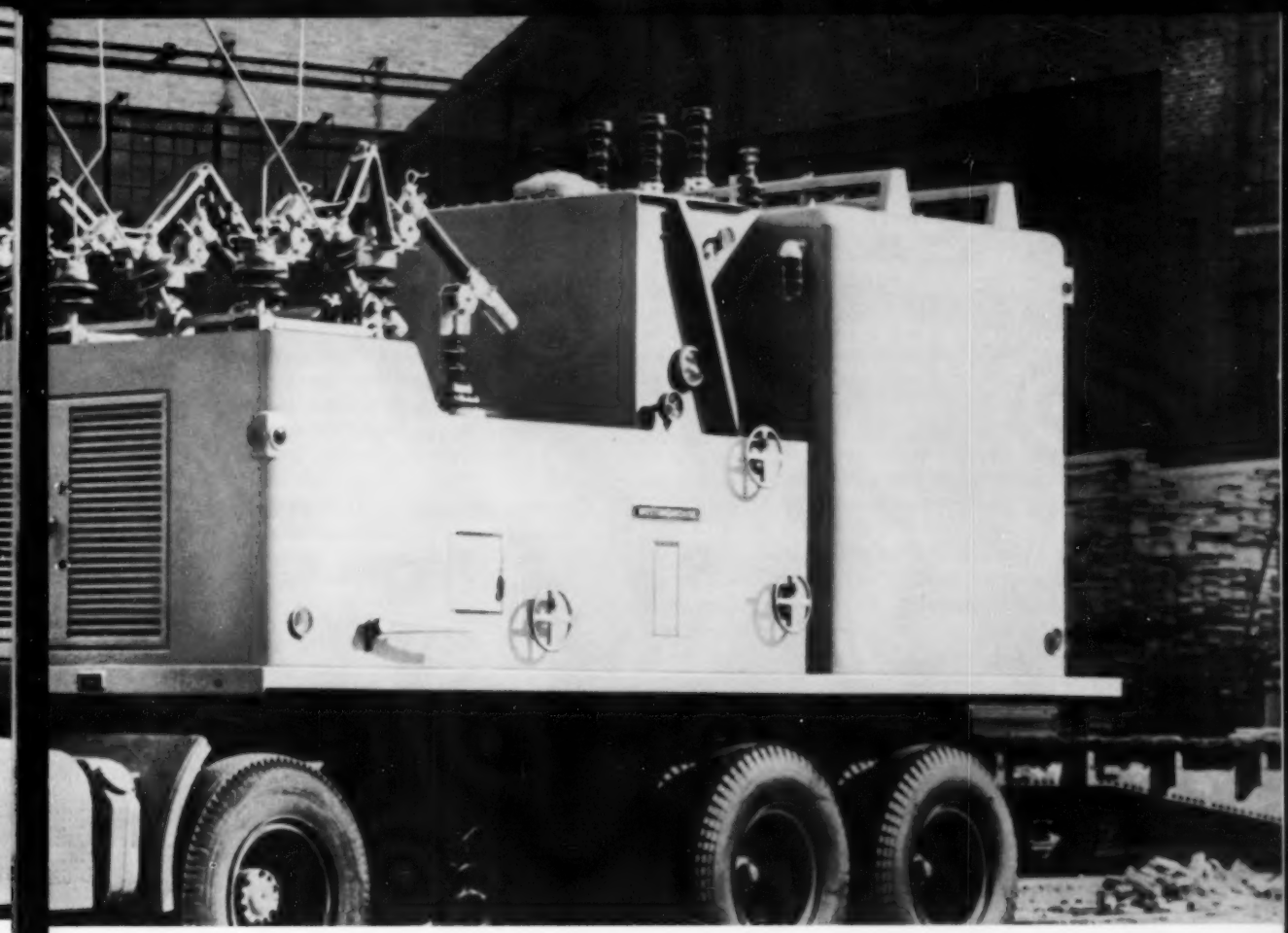
Westinghouse transformers with built-in tap changing underload give you the maximum economic benefits of standardization. For instance: simplified purchasing and engineering; lower initial cost and faster delivery; easier installation; simpler operation and maintenance; and, finally, lower spare parts inventory.

Westinghouse "CSP" power transformers provide the ultimate in simplicity and reliability with still further savings. Their pleasing appearance and low sound level make them welcome "neighbors" in highest class residential areas, thus simplifying your problems of substation site procurement. These compact units combine a 3-phase transformer with integral tap changing underload, secondary switchgear, and all protective equipment in one streamlined package.

Westinghouse has constructed highway mobile transformers as large as 20,000 kva and in voltages as high as 115 kv, and railway mobile transformers as large as 83,333 kva at 220 kv, complete with tap changing underload. The lightweight of the "Form-Fit" design makes possible these higher kva substations within highway limitations.

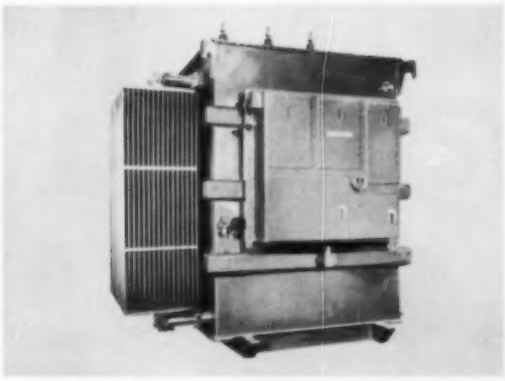
When you plan your new distribution substation, investigate the savings available to you through the use of packaged equipment and mobile substations.

YOU CAN BE SURE...IF IT'S



# new look in substation design

**Contoured-design** "CSP" single-feeder unit substations combine all the advantages of equipment coordination with outstanding appearance and safety. They make wonderful "neighbors" in residential areas.



**"CSP" power transformers** represent the ultimate in equipment coordination for single-feeder substations. Compact, attractive, quiet, safe, "CSP" power transformers are ideal for residential and commercial areas.

Westinghouse

# Westinghouse design engineers match ideas to problems for better products

Westinghouse products are designed with a realistic relationship to problems of not only electrical protection but also load growth, system investment and other factors. Because of this, these products perform better, longer and more usefully. As a group, Westinghouse apparatus goes a long way toward providing system reliability and operating common sense.

To pit new ideas against your problems, Westinghouse has an engineering facility unmatched in the industry. For example, research tells us what is literally possible; system studies, what is economically practical; design, what is physically best. Blending of ideas, methods and materials is the responsibility of these teams of scientists and engineers.

In these pages, we have shown you a variety of new and improved products . . . from end to end of the distribution system. This offers you a clew to Westinghouse look-ahead engineering ability.

**The Man With The Facts . . .** your Westinghouse sales engineer . . . is the one man who can bring this wealth of ready experience to bear on your problems and plans.

**Call *THE MAN WITH THE FACTS...*** for this service package, or write to Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

YOU CAN BE **SURE**... IF IT'S

Westinghouse

**Larry Wrentmore** demonstrates the progress made in distribution transformers in just 8 years.

CP-1028

# INDUSTRIAL NEWS NOTES

## Atomic Cannonballs . . .

The Edison Electric Institute has produced a battery of planned-lighting mailers for utilities to fire at industrial and commercial targets. The bull's eye will be relighting of factories and stores. The mailing pieces are a result of last year's industry-wide survey, which revealed that new, harder-hitting sales ammunition was needed badly.

●

## Not So Hot . . .

Millions of productive dollars are wasted yearly by archaic industrial heating equipment in American factories and plants, reports Carl L. Ipsen, executive vice-president of the Industrial Heating Equipment Assn. in Washington.

About 35% of industry's furnaces and heat-treating gear has grown antiquated. It could even be profitable to replace these facilities, he said.

"If the United States is to limp along with more than a third of its industrial heating equipment out of date, we seriously impede our national defense potential and create bottlenecks that would take months to break in an all-out emergency."

●

## Meandering Mavericks . . .

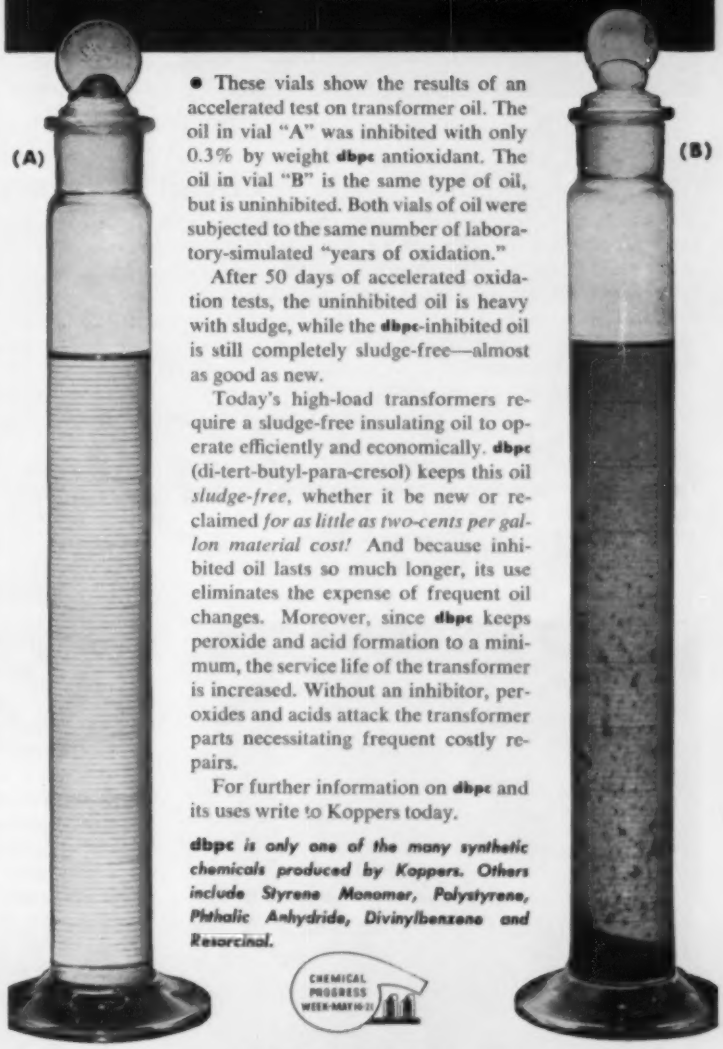
Like discontented steers, Connecticut's youths are leaving the area in herds to seek lush industrial jobs on the other side of the fence. But four utilities are pointing out to high-school sophomores that the Nutmeg State has some pretty green grazing grass.

A 36-page booklet, "There's a Career for You in Connecticut Industry," was prepared under sponsorship of Connecticut Light & Power Co, Connecticut Power Co, Hartford Electric Light Co, United Illuminating Co.

Written by specialists who have attained distinction in their fields, the booklet covers 26 industrial careers. A one-page description is devoted to each career. The type of work, desirable personal qualifications, educational requirements, and scope of opportunity within the state are discussed tersely. Circulation: to guidance experts, libraries, placement bureaus, and employment offices.


Accelerated Oxidation Tests Prove—

**dbpc®-inhibited oil stays sludge-free**




● These vials show the results of an accelerated test on transformer oil. The oil in vial "A" was inhibited with only 0.3% by weight **dbpc** antioxidant. The oil in vial "B" is the same type of oil, but is uninhibited. Both vials of oil were subjected to the same number of laboratory-simulated "years of oxidation."

After 50 days of accelerated oxidation tests, the uninhibited oil is heavy with sludge, while the **dbpc**-inhibited oil is still completely sludge-free—almost as good as new.

Today's high-load transformers require a sludge-free insulating oil to operate efficiently and economically. **dbpc** (di-tert-butyl-para-cresol) keeps this oil *sludge-free*, whether it be new or reclaimed *for as little as two-cents per gallon material cost!* And because inhibited oil lasts so much longer, its use eliminates the expense of frequent oil changes. Moreover, since **dbpc** keeps peroxide and acid formation to a minimum, the service life of the transformer is increased. Without an inhibitor, peroxides and acids attack the transformer parts necessitating frequent costly repairs.

For further information on **dbpc** and its uses write to Koppers today.

***dbpc** is only one of the many synthetic chemicals produced by Koppers. Others include Styrene Monomer, Polystyrene, Phthalic Anhydride, Divinylbenzene and Resorcinol.*

CHEMICAL PROGRESS WEEK-MAY 16-21

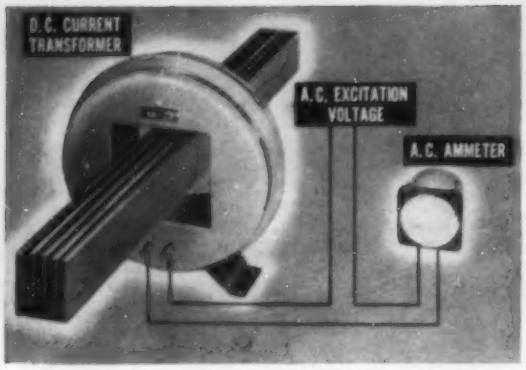
**KOPPERS COMPANY, INC.**
**Chemical Division, Dept. EW-5165 Pittsburgh 19, Pennsylvania**

KOPPERS ®

**Koppers Chemicals**

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA
ATLANTA · CHICAGO · DETROIT · LOS ANGELES

# NEW EQUIPMENT



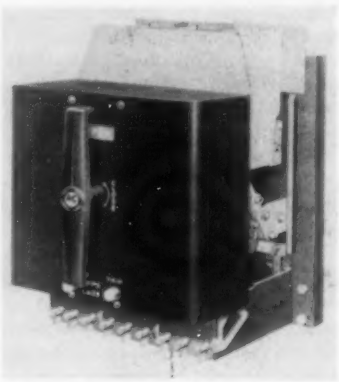

## DC Current Transformer

Improved dc current transformer provides for permanent remote indication of large dc currents by isolating the instrument circuit from the dc circuit. Type JSU-1 incorporates a window design which allows the transformer to be slipped over bus or cable. Other advantages are the elimination of power drain from circuit being measured and elimination of special, bolted-bus-connections.

It is designed for application on electrolytic cells requiring large dc currents and as a feedback source to current balance regulators, dc voltage regulators, motor field and pumpback-current control regulators, and diesel-electric locomotive static excitation controls.

**General Electric Co, 1 River Rd, Schenectady 5, N. Y.**

## Circuit Breakers



Low-voltage air circuit breakers for motor loads, lighting loads, heaters, welders, and transformers have been redesigned for greater accuracy and safety. Safety features include a completely dead front construction and bridge-type contacts without flexible leads or pigtails. An inductive series trip arrangement in higher ratings, hermetically sealed time delay service for trip mechanism, and individual phase trip indications provide greater accuracy. Thermal magnetic, dual magnetic and selective trip devices are available.

The LA-25 breaker has a solenoid operating mechanism. Where ac control power is used, it contains an ac solenoid rather than a rectifier and a dc solenoid. On the LA-50 breaker, closing is by hydraulic system.

LA-25 is rated 40 to 600 amp at 600 v, 25,000 amp interrupting capacity. The LA-50 rating is 200 to 1,600 amp at 600 v, 50,000 amp interrupting capacity. Details in Bulletin 18B8252.

**Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**

## Automatic Controls

Special magnetic amplifier and transistor controls for the operation of complex machinery can be designed to take up less space and provide more reliability than standard control systems.

The absence of moving parts in both devices enables Cypak director systems to be built to go through 20-million cycles of operation in hours or days without showing signs of deterioration or wear. Since these components are smaller than the relays they replace, a considerable saving is effected in the size of complete control systems. Cypak director systems can be built in sizes ranging from that of a table model radio to that of an upright piano, depending on the complexity of the job.

Basic "building blocks" of magnetic amplifier controls consist of magnetic cores and associated circuitry measuring about 5 in. square by ½ in. thick. Transistor units are small metal boxes with prongs.

To date, systems have been built and tested for supervisory control of remote operations on electric power systems and control of an automatic welder (illustrated). The welder, installed several months ago, has performed over one quarter of a million welding operations.

**Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.**

(*More New Equipment on page* 170)

# Match those long-life poles with long-life guys!

use Copperweld® Strand

*—it lasts as long as the poles*

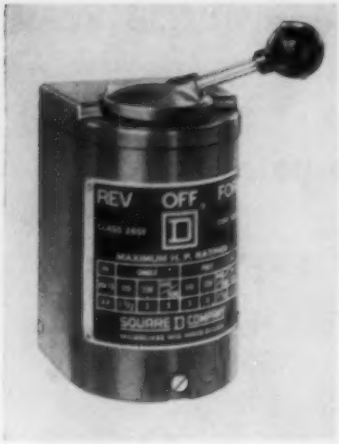
Let's face it. Modern poles last 30 to 40 years—and more. So, it's just common sense to use guy strand that lasts as long as the poles. The cost of the strand is a small part of the installation. Invest just a little more for Copperweld* Guy Strand and get a lot more service at lower annual cost.

*Trade Mark

**COPPERWELD STEEL COMPANY**
WIRE AND CABLE DIVISION
Glassport, Pa.
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

1955 –our 40th year

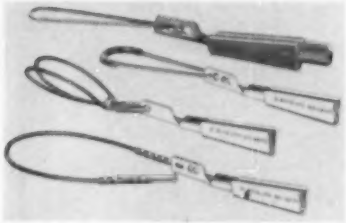
Copperweld GUY STRAND




## Drum Switch

Reversing drum switch provides a choice of either "maintained contact" or "spring return to off" in the same switch. This Size 1 controller is designed for across-the-line starting and reversing of ac polyphase or single phase motors, or dc motors. Current carrying parts are heavy copper to assure adequate capacity for severe applications. Contacts are plated for maximum life.

**Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.**



## Service Drop Clamp

Aluminum service wedge clamps are available with four types of bails for dead ending aluminum service drop wires. As illustrated, standard Type W-A (top) has stainless steel bail with one end free and other held by the wedge. Type W-A-VP is the same except that bail is covered with an abrasion resistant vinyl plastic at point of contact with insulator. Types W-A-FC and W-A-FF have bails of flexible copper braid. Both ends of former are held by the wedge. The latter has one end free.

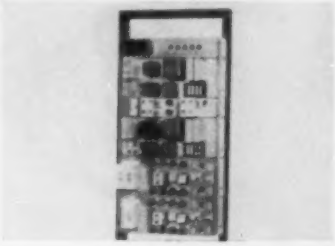
Two sizes are available in all types. W2 series covers a wire range from No. 2 solid aluminum to 1/0 ACSR. W6 series covers a range from No. 6 solid aluminum to No. 4 ACSR.

**Jasper Blackburn Corp, 35 Madison St, St. Louis, Mo.**

## Carrier Relaying

Voice frequency carrier equipment is designed for transferred-trip protective relaying of transmission lines. Primary protection by transferred-trip enables high-speed simultaneous opening of all circuit breakers in a line section and faster reclosing than possible with sequential tripping methods. Effects of line faults are thus minimized, permitting higher line loading.

The equipment provides high-speed



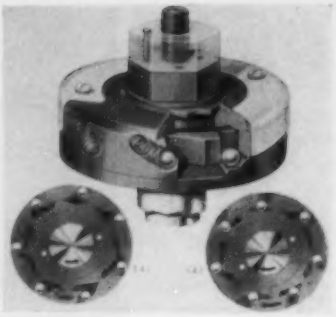
transmission of tripping information between terminals by shifting the frequency of a continuous carrier. Operating time for the overall relaying channel is 10 milliseconds. Four relaying channels can be transmitted over one voice channel. Reliability in transmitting tripping information and security against false tripping meet requirements for primary protection, according to the manufacturer.

Continuous channel supervision provides immediate indication of abnormal conditions. Receiver will not operate during abnormal conditions which might result in false tripping.

**Motorola Communications & Electronics Inc, 4501 W. Augusta Blvd, Chicago 51, Ill.**

## Vertical Motor

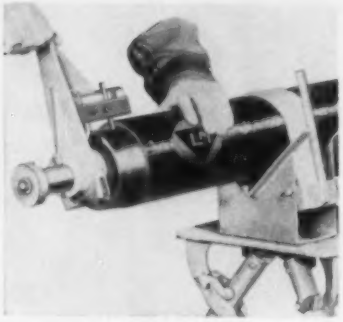
Vertical hollow-shaft pump motor has a ball-type, non-reverse ratchet which locks within 1/72 of a revolution and physically prevents motor and pump from rotating in reverse. The Bal-lok ratchet element remains stationary while the ball retainer rotates with the motor. When the motor operates in the proper direction (1), centrifugal force lifts the balls



clear of the ratchet. As the motor stops (2), the balls drop back into the ratchet recesses and prevent rotation in the opposite direction. The device is available on motors up to 200 hp.

Other new motor features include an overhung, canopy-type hood for protection against the elements; heavy duty, single-row ball thrust bearings; high capacity centrifugal-fan cooling; and dynamically balanced rotors.

**ACEC Electric Corp, 40 E. 49th St, New York 17, N. Y.**



## Conduit Tool

Self-feeding tool will taper and face-off fiber conduit ends to factory exactness. Type 504-C is especially designed for the company's 4-in. Perma-Line conduit. As handle is revolved manually, a threaded feed mechanism guides two tool bits forward to obtain a uniform cut. The unit weighs 8¾ lb and is furnished with a metal carrying case.

**Line Material Co, Milwaukee 1, Wis.**

## Miniature Battery

Rechargeable storage battery, measuring ⅞ in. x ⅝ in. x 1⅛ in. high, is designed for use in portable telemeter-

(*Continued on page* 174)

*Greater public safety...at new low cost to you*

## Hubbard's new Glo-Guard Guy Protector

Now you can get added protection for the public at a new low cost . . . with Hubbard's *Glo-Guard* Guy Protector. *Glo-Guard* has the added feature of luminous areas that reflect brightly in headlight glare. And the *Glo-Guard* is easily visible on dimly lighted streets or poorly lighted areas to warn pedestrians of dangerous projections.

Hubbard's new *Glo-Guard* Guy Protector is available in two lengths, 7 feet (Stock No. 718) and 8 feet (Stock No. 818). Attachment holes and clips are spaced for mounting on guy wires, rods or clamps at any height. It is formed from Cor-ten steel for long life and high strength.

*Glo-Guard* is the latest addition to Hubbard's complete line of Guy Protectors. Also available is Hubbard's *Loxfast* Guy Protector. With only one bolt to tighten, the *Loxfast* is designed for fast installation and long years of service. *Loxfast* is available in 7 foot lengths (Stock No. 7657 Light and Stock No. 27657 Heavy) and 8 foot lengths (Stock No. 7658 Light and Stock No. 27658 Heavy).

Another Protector, popular with utilities, is Hubbard's *Half Round* Guy Protector. Edges of the *Half Round* are turned in for greater rigidity and safety. The *Half Round* is also available in two lengths, 7 feet (Stock No. 7557) and 8 feet (Stock Number 7558 for two bolts and Stock No. 7559 for three bolts).

For information on Hubbard's complete line of Guy Protectors, please contact your nearest distributor or Hubbard and Company, 6301 Butler Street, Pittsburgh 1, Pa.

**HUBBARD** AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.

## Save up to 30% on service drop installations with

# Rome Aluminum

You save as much as 30% on initial cost and installation expense by specifying Rome Aluminum Triplex in place of conventional Type SD service drop cable.

You cut maintenance costs and service interruptions, too. The triplex construction gives your installations high resistance to storm damage, wind and ice loading.

You get full protection against effects of sunlight, heat, moisture, corrosive atmospheres and other hazards from the rugged RoPrene (Neoprene) or RoLene (polyethylene) insulations which are standard on Rome Aluminum Triplex. Rome Triplex Conductors can be supplied with an inner layer of high-quality rubber insulation, covered with a durable, tough Ro-Prene (Neoprene) sheath, when specified.

And you get a cable that's "public relations minded," because triplex installations are neat—no cluttered unsightly open wires, no braids to rot and festoon. Full information is yours for the asking. Write today for Bulletin RS-5.

# Triplex

**Rome** ALUMINUM

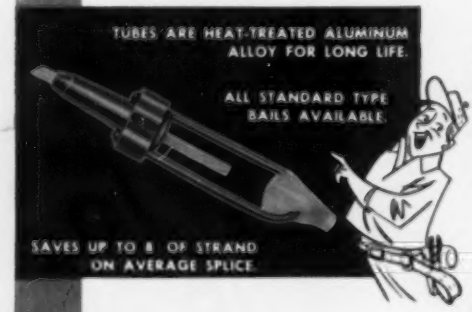
**Rome Cable Corporation, Rome, New York, and Torrance, California**

# STRANDVISE®

## THE SELF-ACTING SELF-CONTAINED TOOL FOR TERMINATING STRAND

Wherever strand is to be terminated, STRANDVISE provides a means that is unmatched for speed and versatility. Many Utilities now know what STRANDVISE does for their pocketbooks.

STRANDVISE makes it possible to install guy wires without waste of time or strand, to terminate suspension strand or ground wire quickly and easily. STRANDVISE, equipped with a new 18" flexible bail, simplifies "false dead-ending" (slack span construction).


TUBES ARE HEAT-TREATED ALUMINUM ALLOY FOR LONG LIFE.
ALL STANDARD TYPE BAILS AVAILABLE.
SAVES UP TO 8' OF STRAND ON AVERAGE SPLICE.

STRANDVISE grips surely yet permits easy accomplishment of desired tension or later adjustment to take up slack in strand.

*Write for sample STRANDVISE so you may see for yourself its many advantages.*

Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Illinois

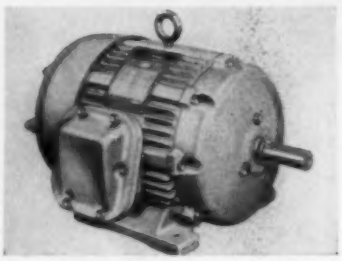
Over 45 years of service to the utilities

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES


## New Equipment

(*Continued from page* 170)

ing, communications, recording and photographic equipment. The ½ amp-hr cell is built on a silver-zinc principle and weighs 1/6 oz. It has a flat voltage output and a maximum continuous drain of 500 ma. Peak pulse current is in excess of 2 amp. **Yardney Electric Corp, 40 Leonard St, New York 13, N. Y.**



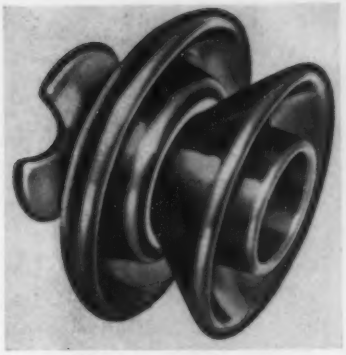
### Motors

Explosion-proof motors can be used in all Class 1, Group D, and Class 11, Groups E, F, and G hazardous locations. This is said to reduce stocking problems since a single motor can be used in most hazardous locations. Motors are available in ratings of 1 to 25 hp, 3 phase, and 1 to 3 hp 1 phase. Modified 3-phase motors are available for Class 1, Group 3, locations.
**Louis Allis Co, Milwaukee 7, Wis.**

### System Recorder

Improved "fact-finding" instrument is designed to help utilities study present electrical systems and plan for future expansion, according to the manufacturer. The "Type 44 Recorder" is said to simplify the job of making load studies in generating stations, substations and in field system surveys. It is available in forms to record data on circuit conditions such as voltage, current, power, reactive power and frequency.

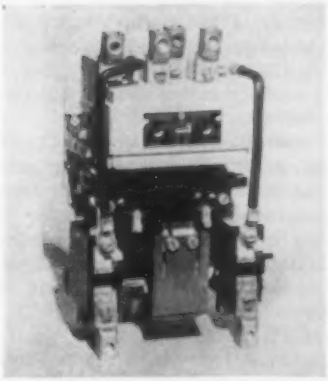
Recorder is capable of operation for 70 days without changing the 100-ft chart paper on which information is recorded. It can also be used in industry to check machine and production line performance.
**Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.**



## Pin-Type Insulators

High-voltage, multipart, pin-type insulators, in the EEI-NEMA class 56-1 through 56-5, are designed for service on transmission and sub-transmission systems. They are made of wet-process porcelain and are available with either plain or radio-free glaze. Insulators are being distributed by Line Material Co, Milwaukee 1, Wis.

**Illinois Electric Porcelain Co, 510 N. Pearl St, Macomb, Ill.**



## Magnetic Starter

NEMA size 4 class vertical lift magnetic starter is 40% smaller, physically, than previous models of the same rating. It is designed for motors up to 100 hp and mounts in the same cubicle as the size 3 model. A permanent air-gap causes the starter to drop out when de-energized regardless of age and usage. Overload protection is provided by a bimetallic overload relay.

Starter is available in reversing, multi-speed, and combination forms with either vertical or horizontal mechanical interlocks. Starters are for

(*Continued on page* 176)


# STRANDLINK®

**THE SELF-ACTING SELF-CONTAINED TOOL FOR SPLICING STRAND**

Wherever strand is used, whether for ground wire, suspension strand, down guys or anything else, STRANDLINK is the most economical means for splicing.

STRANDLINK makes the splicing of any grade or size strand simple and easy yet safe and sure. The exclusive Reliable Pilot Cup caps and guides the strand to its proper position. Nuts, bolts, hardware and johnny balls are eliminated. STRANDLINK costs much less than alternate pieces of hardware before installing time is even taken into account.

Hundreds of case-hardened, plated steel teeth in each gripping chuck HOLD firmly and permanently. Assembly is factory treated with corrosion inhibitor lubricant.

*Ask on your company letterhead for a sample STRANDLINK; it will be sent promptly without charge.*

JAWS OF GRIPPING CHUCK SURROUND STRAND TO HOLD PERMANENTLY
PILOT CUP IN NOSE GUIDES STRAND THROUGH
MADE FOR ¼" TO ⅝" STRAND.

Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Illinois

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

# *Directors' Meeting ...THE MORNING AFTER*

In the middle of the night fire hit here with sudden blasting fury. In *seconds*, it turned vital equipment into smoking junk. Next morning the directors could rightfully ask, *"Where was our fire protection?"*

Unfortunately, it lay in a desk drawer—a proposal for a fire extinguishing system that would have made the key hazards at this plant fire-safe. Procrastination pigeonholed protection . . . and disaster didn't wait!

In generators, transformers, switching equipment and other utility danger spots fire can strike with crippling effect—with ordinary protection helplessly inadequate. That is why, when CARDOX originated "Low Pressure Carbon Dioxide Systems"* many years ago, the first such system went into a central station. The utility industry has since installed many, many more—as the best and safest protection for millions of dollars worth of equipment. CARDOX $CO_2$, applied in *any* quantity required, holds fire damage to a minimum—and eliminates extinguishment damage entirely.

Why not ask for a CARDOX Survey and recommendation on your hazards? There's no cost or obligation.

*Covered by Patents Issued & Pending

CARDOX

ORIGINATOR OF Low Pressure $CO_2$

FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • BELL BUILDING • CHICAGO 1, ILLINOIS

Offices in Principal Cities

## New Equipment

(*Continued from page* 175)

polyphase motors rated 220 v, 50 hp and 440/550 v, 100 hp.

**General Electric Co, 1 River Rd, Schenectady 5, N. Y.**

## Direct Reading Meters

Direct reading permanent magnet moving coil type instruments have been redesigned to provide inherent shielding, greater stability, rapid response, excellent damping and continued accuracy, the company says. Model 1 has a core magnet mechanism containing an Alnico V core inside the moving coil. Outer frame of the mechanism serves as the yoke and provides shielding and minimum loss of flux.

Being relatively immune to the effects of external field influence, the movement has a high degree of magnetic stability. It is claimed that the instrument may be used at a distance of only 15 in. from a conductor carrying 1,000 amp and will show an effect of less than 1/10 of 1%.

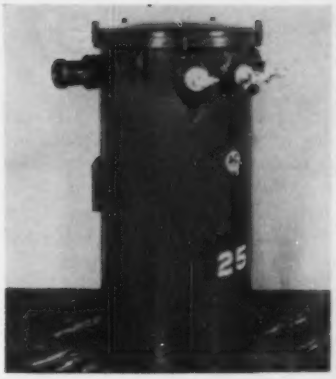
Model 1 may be left in the circuit continuously or subjected to a wide range in temperature without serious effect on reading accuracy. Accuracy is ¼ of 1% full scale.

**Weston Electrical Instrument Corp, 614 Frelinghuysen Ave, Newark 5, N. J.**

## Transformers

Distribution transformer design changes include improvements in tank and cover shape, gasket principles, bushings, coil supports, tap changers and terminal boards.

Lip of tank is formed into a square-cornered bead, the structural shape of which is said to contribute toward

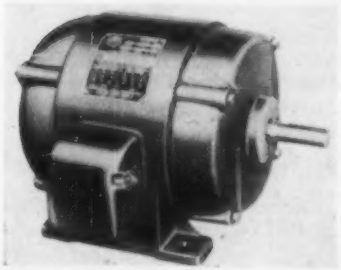


greater strength and keep the tank in round. Top surface of bead serves as a seat for tank gaskets. Heavy gauge steel cover is formed with a high dome and its edge conforms to shape of tank lip. Retained gasket is compressed by J-bolts which hook under the tank lip.

High and low-voltage bushing terminals are electro-tin plated to reduce galvanic action with aluminum conductors. A cast-in electrode on terminal of high-voltage cover bushings permits a more positive and permanent gap arrangement for lightning arresters, it is said. A cast-in neutral gap is provided on low-voltage center bushing. Molded glass mat polyester blocks with adjustable screw arrangement provide coil bracing supports.

Tap changer has a porcelain base. Without taps, the base is used as a terminal board to which incoming high-voltage lines and coil leads are clamped.

**Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**



## Drip-Proof Motors

Smaller frame motors provide greater hp at higher efficiencies, according to the manufacturer. Drip-proof design motors have a lower air opening in the end-bell and a steel

(*Continued on page* 178)


HUBBELL
REG. U.S. PAT. OFF.

# THE ANSWER TO YOUR GROUNDING PROBLEMS

**No. 5273-L**
Heavy-duty Composition Adaptor

**Rugged 3-Wire Caps with U-shaped Blade for Grounding**

**No. 5262**
Specification Grade Convenience Outlet

**No. 5264**
Armored cap with cord grips.

**No. 5274**
Finger-grip type

**No. 5266**
Rubber cap with cord grips.

*Just a reminder to our industrial customers that, wherever grounding is necessary, code regulations now require 3-wire grounding-type caps (see right) on many types of portable electrical equipment rated 125 volts or less. Many tools that you purchase from now on will be supplied with this 3-wire cap with U-shaped grounding blade. Do you have the 3-wire devices to accommodate it? Can you plug-in?*

Be fully prepared for every condition by contacting your electrical contractor and wholesaler for full information about Hubbell grounding devices. Hubbell's complete line fits every need . . . satisfies the top industrial standard for rugged, dependable, and versatile wiring devices.

*Also a complete line of 250-volt rated grounding devices.* Literature on request.

**No. 5278**
Motor Plug Base (male)

**No. 5279**
Motor Plug Base (female)

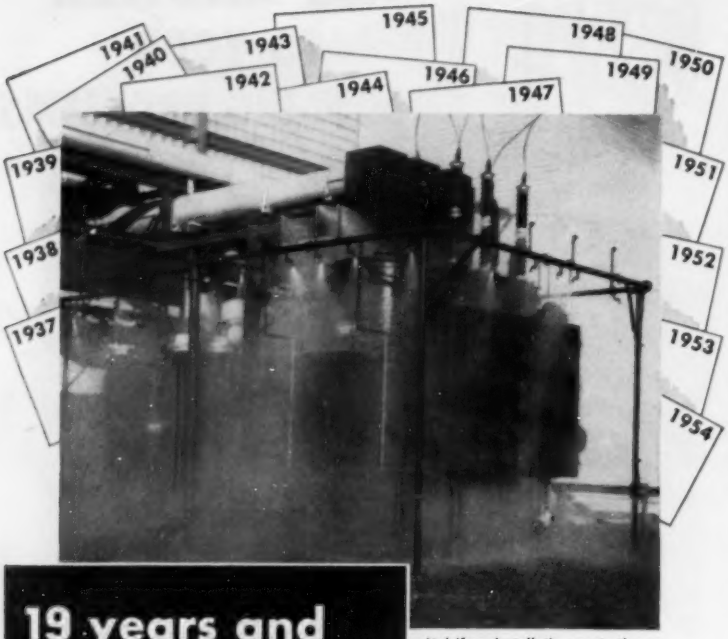
**No. 5252**
Competitive grade convenience outlet for residential applications.

Highest Grade
HEAVY DUTY
WIRING DEVICES
HUBBELL

14HH55

**Be sure to visit us at the NAED Convention, Conrad Hilton Hotel, Chicago, Illinois, May 22-25, HUBBELL BOOTH #146 . . . or visit our hotel suite.**

**HARVEY HUBBELL, INC.** DEPT. E-2 **BRIDGEPORT, CONN.**




**19 years and 28 installations ago...**
**at Philadelphia Electric Company**

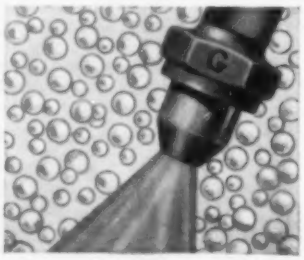
Mulsifyre installation protecting a 105 MVA transformer at the newly completed, modern Cromby Station of Philadelphia Electric Company, Phoenixville, Pa.

It was back in 1937 that Philadelphia Electric Company installed its *first* Grinnell system of Mulsifyre Protection.

The record achieved in the intervening years speaks for itself . . .

During the past 18 years, Philadelphia Electric Company has authorized Mulsifyre Protection for 28 different stations and sub-stations in its far-flung operation. This "repeat business", from a single user, is evidence of unsurpassed performance.

If *your* transformers are not protected by this effective emulsion-forming spray system, don't take chances. Get quick-acting Grinnell Mulsifyre. Complete extinguishment of fires within areas protected with Grinnell Mulsifyre sprays usually is obtained in a matter of seconds after the water discharge starts. For full details, write Grinnell Company, Inc., Providence, R. I. Offices in principal cities.



**GRINNELL *Mulsifyre***

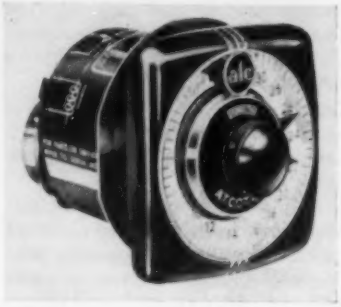
**EMULSION-EXTINGUISHMENT OF OIL FIRES**


## New Equipment

(*Continued from page* 177)

baffle plate to give maximum protection to winding from moisture and abrasive dusts. Double-end ventilation is provided by dual cast aluminum fans. Standard ratings are available in NEMA frame sizes 182, 184, 213 and 215.

**Lima Electric Motor Co, 39 Findlay Rd, Lima, Ohio**



## Timer

Automatic reset timer with dial setting is said to incorporate high accuracy, compactness, extreme flexibility and low cost for timing and sequencing of electrical load circuits on industrial machinery and process operations. All timing ranges use the same internal operating mechanism, housed in basic chassis and cover. Interchangeable dials and motors provide 10 timing ranges from 0 to 240 sec. Minimum range is 0 to 15 sec.

"Atcotrol" mounts in a cut-out 3-3/16 in. diam. Interchangable self-cleaning contacts are rated 10 amp, 115 v, ac. Ask for Bulletin N-140.

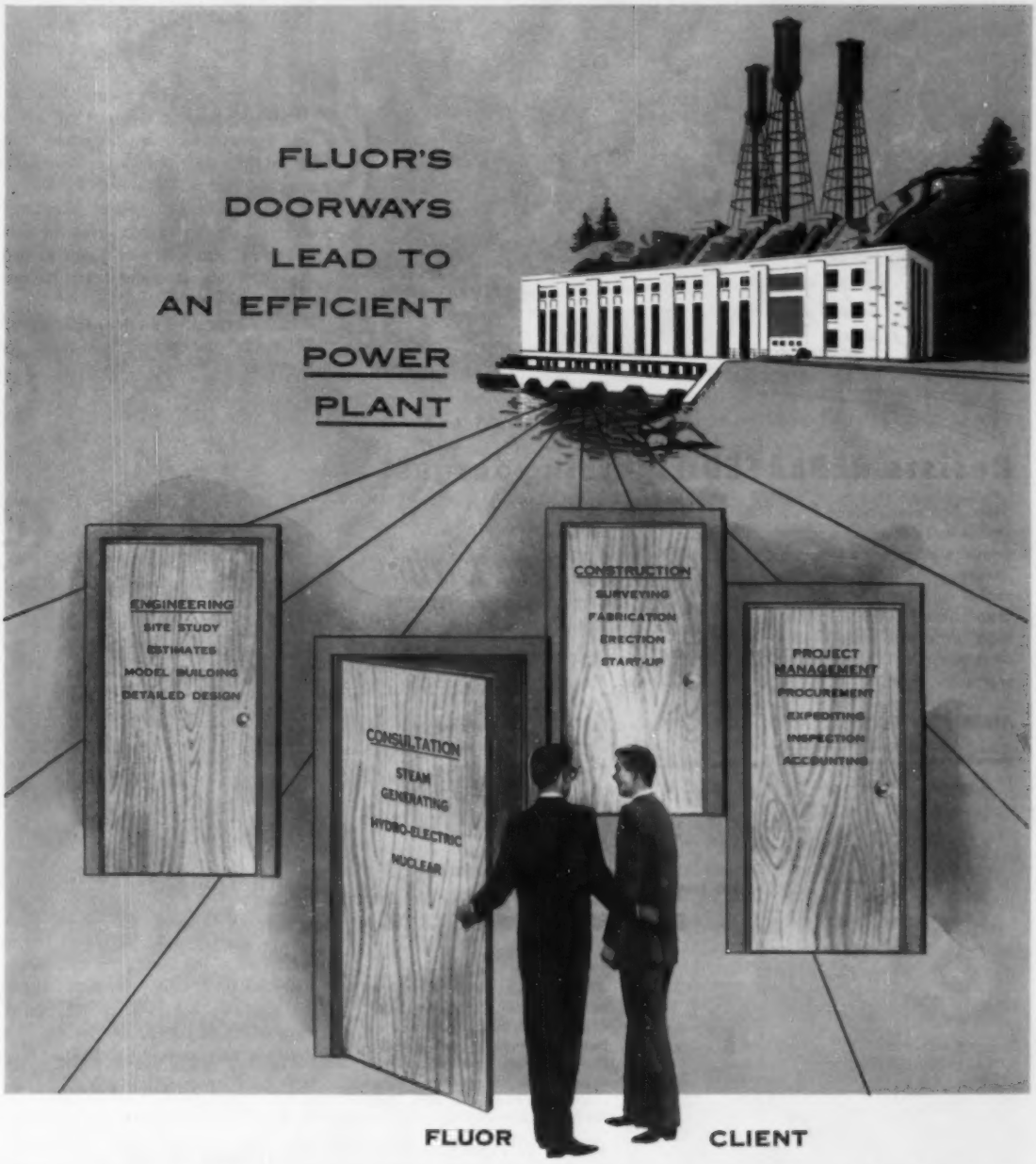
**Automatic Temperature Control Co, 5200 Pulaski Ave, Philadelphia 44, Pa.**

## Printing Tube

Electron-image tube translates coded signals from tape, keyboard or radio into clearly-defined letters and figures at speeds up to 100,000 words per min for high-speed photographic recording.

The tube simulates typesetting in selecting letters and figures one by one from a "font", placing them in luminous form on the 5-in. circular tube face either in lines or in any

(*Continued on page* 180)




Fluor employs all skills and possesses the facilities to design, engineer, procure and construct for the power industry, anywhere on the face of the earth. Fluor assumes complete responsibility for all details—from site studies to initial plant operation—and can write any kind of contract desired ("Turnkey," "Guaranteed maximum," "Cost plus," or any other). Through its affiliate, H. G. Acres & Company, Ltd., Niagara Falls, Ontario, one of the outstanding engineering and construction firms of Canada, Fluor has access to valuable hydro-electric experience to supplement its own activities in the design and construction of steam generating units. Whatever your needs, an indoor or outdoor plant of any capacity, hydro or steam generating (conventional or nuclear fueled)—see Fluor first.

BE SURE WITH

**FLUOR**

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA, U.S.A.

FLUOR OF CANADA • TORONTO
HEAD WRIGHTSON • LONDON
AFFILIATES: SINGMASTER & BREYER, NEW YORK; H. G. ACRES & COMPANY, LTD., NIAGARA FALLS, ONTARIO, CANADA

ENGINEERS
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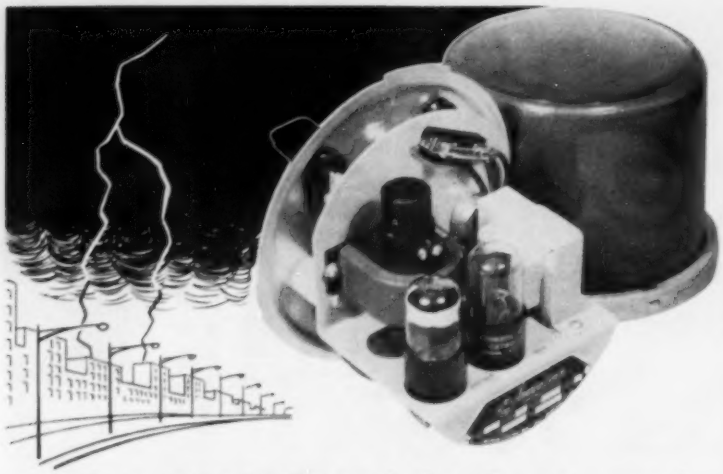
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA
DENVER



**Resists REPEATED Lightning Surges!**

Stop lightning-induced control failures! Get 60% greater surge protection from new "Mercury to Mercury" contactor and layer wound coil. Guaranteed 5000 volts RMS high potential rating—plus control switches a full 3600 watts of lighting load.

American Electric
LIGHTING CONTROLS

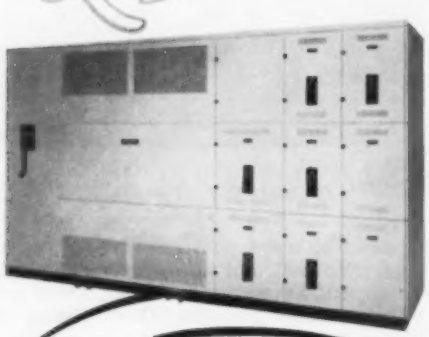
▪ Write today for catalog and prices, 3000 series. No obligation.

**AMERICAN ELECTRIC MFG. CORP.,** Dept. E., 34 N. Orleans, Memphis, Tenn.

**"It ain't tin!"**

**. . . says the man who installs a**

**NELSON UNIT SUBSTATION**



Nelson unit substation with incoming load break interrupter switch, 500 kva air-cooled transformer and low voltage main and branch breakers.

To protect the fine components that form the operating heart of a Nelson unit substation, we build heavy-duty steel enclosures that are strong and solid throughout. Extra-heavy steel channels provide a firm base for the assembly.

Nelson unit substations are manufactured with air, oil or non-inflammable, liquid-filled transformers; and, built integrally with these transformers, are Nelson switchgear, motor control centers and all-in-one substations.

Maximum voltages from 13,800 volts primary to 600 volts secondary.

• Write for literature . . . . .

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA
217 N. DETROIT AVE. TELEPHONE 2-5131

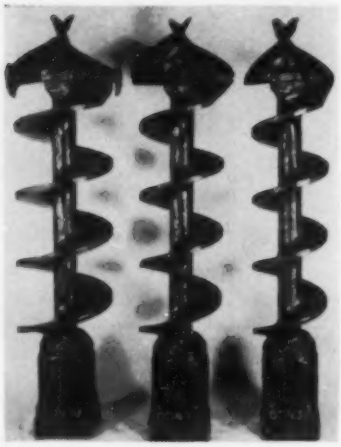

## New Equipment

(*Continued from page* 178)

pattern desired. The "font" is a lantern slide bearing a chart of letters and figures which are projected from outside the tube onto a sensitive layer at rear of tube.

The ability to place characters where they are wanted gives the tube wide flexibility for such tasks as producing financial statements, balance sheets and bills.

**Radio Corp. of America, RCA Bldg, 30 Rockefeller Plaza, New York 20, N. Y.**



## Earth Augers

Small diameter, heavy duty flight augers are for use with earth boring machines of the type used by utilities. PENGO 6, 7, and 8 in. diam augers are made of heat treated manganese moly alloy cast steel.

**Petersen Engineering Co, Santa Clara, Cal.**

## Watthour Meter

The increased demand for residential current has resulted in the design of a watthour meter with more than adequate capacity for future loads. Overload capacity of the 15 amp model has been increased from 60 to 100 amp to provide greater accuracy at increased consumption. A larger unit with a 30-amp rating has an increased overload capacity of 200 amp, and is said to be more efficient than an earlier 50-amp meter. Both meters

(*Continued on page* 182)

# CHANCE *MAPLAC** HOT LINE TOOLS

## offer these 3 Important Advantages!

### 1.*PLASTIC PROTECTION

The poles used on all Chance Hot Line Tools are completely sealed and protected with a super-tough, crystal-clear plastic finish that resists surface abrasion—is unaffected by oil, grease, gasoline, or salt water—that perfectly seals joints around metal fittings—that retains its toughness under widely varying temperatures—and can be readily repaired without special tools or heat if the coating should be cut by a sharp blow. This "Maplac" coating offers great moisture resistance and has electrical resistivity that exceeds the voltage withstand tests of the wood insulation.

### 2. ALUMINUM FITTINGS

Chance Hot Line Tools are lighter in weight, where the weight is important, because the end fittings are made of heat-treated aluminum alloy. This weight reduction—with larger, stronger fittings—relieves the strain on the lineman—making hot stick work easier, safer and more efficient. Ask the men who use them! They prefer Chance Hot Line Tools because their light weight and good balance cuts down fatigue—makes them easier to use.

### 3. QUICK CLAMPING, SAFE LOCKING ATTACHMENTS

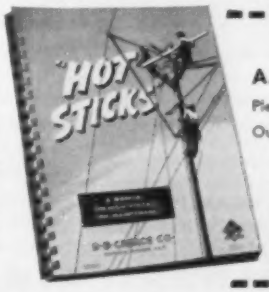
All Chance Hot Line Tools which require mounting on poles are equipped with this light weight chain tightener that clamps the tool quickly to the pole by a simple lever operation. A specially designed safety catch automatically and securely locks the tool support in place. The latch cannot be released unintentionally or accidentally. A half link adjustment of the chain assures a snug fit on any pole.

**NEW**... a manual on **how to do Hot Line Work**

162 pages of detailed explanations—with hundreds of drawings and diagrams that show every important operation.

Supply your line crews with this valuable aid to safety. Price is $2.50 a copy. Use the coupon at right to place your order.

CHS5-16A




ABC Member

**A. B. CHANCE CO. • 205 N. Allen St. • Centralia, Mo.**

Please send us _____ copies of "Hot Sticks" priced at $2.50 a copy.

Our check for $_____ is enclosed. Bill us for _____ copies.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

## New Equipment

(*Continued from page* 180)

carry a lifetime guarantee.

Meters are adaptable to outdoor mounting and are designed to withstand outdoor temperature changes. Lightning arresters are built into the base. All parts of the device are treated for corrosion resistance and precision gears are gold finished.
**Westinghouse Electric Corp, 95 Orange St, Newark, N. J.**

## Lighting System

A complete lighting system has been designed for use in hazardous areas (Class 1, Groups A and B) where acetylene and hydrogen are present. System consists of: 150 and 200-w EVA pendant lighting fixtures (illustrated), EAB junction boxes, FSPC tumbler switches, EYS seals, UNY unions, and EC series flexible couplings and flexible fixture hanger supports.
**Crouse-Hinds Co, Wolf & Seventh North Sts, Syracuse, N. Y.**

## Repair Tower

Truck mounted repair tower can be demounted and used on the ground or in buildings. It is driven by a power take off from the truck engine and when demounted it can be hand driven or motor operated. A self-locking winch insures safety under all conditions. The unit is supplied in one piece in various lengths. It is of all welded, steel construction.
**Atlas Industrial Corp, 849 39th St, Brooklyn, N. Y.**

## MORE NEW PRODUCTS

Killark Electric Mfg Co, Vandeventer & Easton Aves, St. Louis, Mo., has explosion-proof **lighting fixtures** which are said to combine lighting efficiency with cooler and safer operation. Ratings are from 100 to 500 w . . . Gibson Mfg Co, 1919 Piedmont Circle, N.E., Atlanta, Ga., has **fixtures** mounted on Uni-Race channel which can be joined together to provide an unbroken, open wire-way of any desired length.

American Products, Inc, 678 Massachusetts Ave, Cambridge, Mass., is marketing apparatus designed for correct administration of the "Eve" method of **artificial respiration.** The Eaton Rocking Resusitator is a precision device designed to rock the victim rhythmically to a definite degree of tilt and in approved sequence to provide necessary ventilation, circulation and warmth.

Telectro Industries Corp, 35-18 37th St, Long Island City 1, N. Y. offers **encapsulating compounds** in transparent, flexible and foam types.

Thomas C. Wilson, Inc, 21-11 44th St, Long Island City 1, N. Y. has designed an air or water operated **cleaning tool** for removing soft deposit accumulations from condensers in steam power plants.

Duracote Corp, Ravenna, Ohio, has **fire resistant utility curtains** made of Fiberglass or Nylon yarn coated with synthetic plastic resins.

General Electric Co, Nela Park, Cleveland 12, Ohio, has developed a 750-w **high-voltage lamp** using an R-52 bulb for use in high-bay industrial areas. It operates on 230-250 v systems.

Trio Laboratories, Inc, 3293 Seaford Avenue, Wantagh, Long Island, N. Y., has minature, panel-mounting, dc **vacuum tube voltmeters** with 3% accuracy and 10 megohms input impedance. Model F meters are available with single scale sensitivities ranging from 1 to 300 v.

Gudebrod Brothers Silk Co, Inc, Electronic Div, 225 W. 34th St, New York 1, N. Y., offers braided, rubber-covered Nylon **lacing tape** which is said to give knot security with either continuous or interrupted ties in electrical harnesses . . . American Silver Co, 36-07 Prince St, Flushing 54, N. Y., makes ultra-thin, high precision tolerance **nickel clad steel strip** for use in electrical applications. Strip is produced in thicknesses down to 0.003 in. and widths down to 0.93 in.

Herman H. Sticht Co, Inc, 27 Park Pl, New York 7, N. Y., has 3½ in. flush panel mounting, vibrating reed **frequency meters.** Available models cover ranges from 15-1,500 cycles . . . Link Welder Corp, 13684 W. Buena Vista, Detroit 27, Mich., has resistance **welding presses** adaptable to a variety of sheet metal fabrication and end product manufacturing applications.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa., offers watertight, sheet-steel **enclosures** for all combination linestarters through NEMA size 2 . . . Independent Metal Strap Co, Inc, 230 Third St, Brooklyn 15, N. Y., has a self-contained tool which forms any size **clamp** with metal strap made of copper, brass, or regular, galvanized, and stainless steel.

Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio, offers a **pneumatic receiver** with drift-free stability for instrument and control systems.

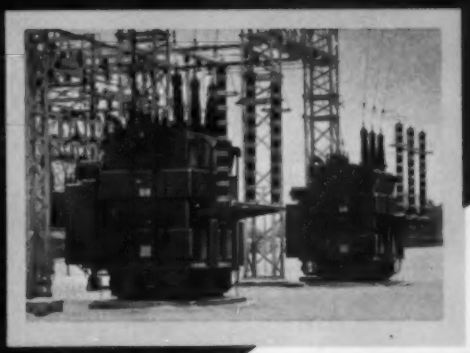
Hobart Brothers Co, Troy, Ohio, has an electric motor driven dc **arc welder** with a welding range of 5 to 300 amp.

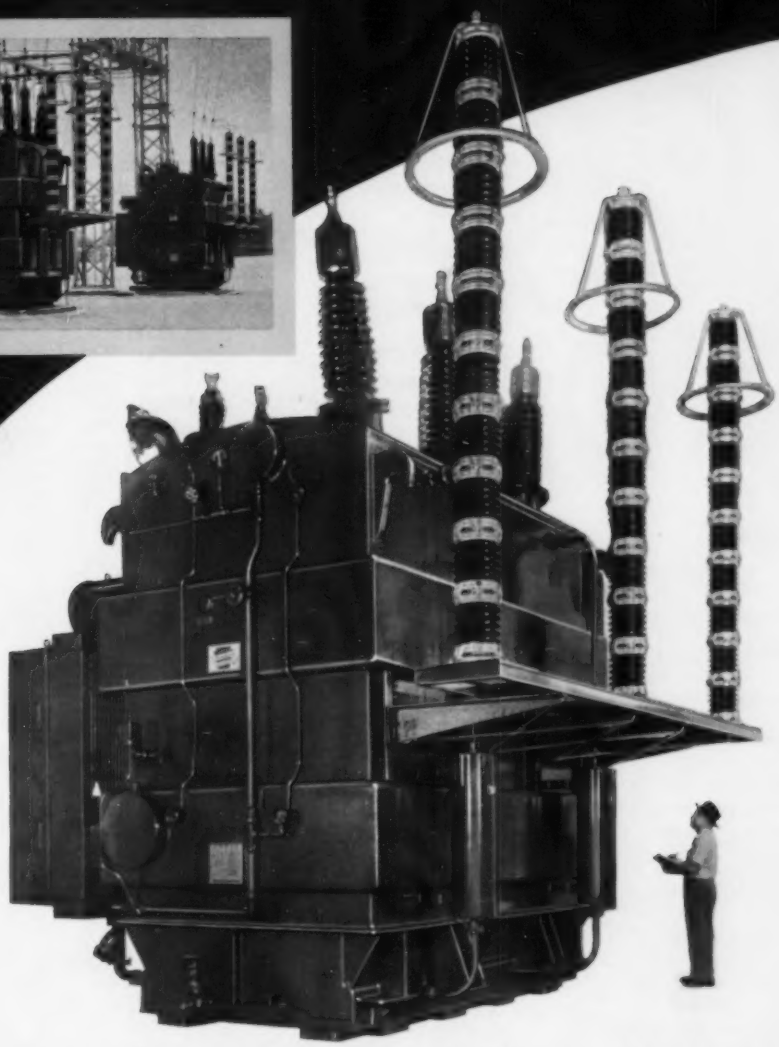
Stackpole Carbon Co, St. Marys, Pa., has fractional hp **motor brushes,** Grade 373, which are said to display unprecedent life and performance characteristics on small universal motors . . . Bristol Co, Waterbury, Conn., has an instrument that combines a two pen, two-cam, **time-program controller** with a cycle controller which times up to eight operations.

Ilsco Corp, Cincinnati 27, Ohio, is making **shading coils** for motors from electrolytic seamless copper tubing cut burr-free and of uniform length and thickness . . . Bausch & Lomb Optical Co, 635 St. Paul St, Rochester 2, N. Y., offers a dual grating **spectro-**

(*Continued on page* 185)

# PENNSYLVANIA 40,000 kva *three phase* CONTOUR DESIGN LOAD RATIO CONTROL TRANSFORMER





see next page for inside story

Two identical 40,000 Kva Pennsylvania Load Ratio Control Transformers traveled by train and truck in an upright position to their substation. The transformers were completely assembled except for forced cooling equipment and bushings. Installation was therefore relatively fast and easy, and much of the credit for that goes to Pennsylvania's space-saving, shell-form Contour Design. 32-step tap-changing underload equipment maintains a constant low voltage, with the high voltage varying from 100% to 80% of normal voltage. The transformer has a high voltage rating of 132,000 volts; a low voltage rating of 36,000 volts; and a 13,650 tertiary voltage at 14,000 Kva.

**PENNSYLVANIA TRANSFORMER COMPANY**

*A McGraw Electric Company Division* • **CANONSBURG, PA.** • *Greater Pittsburgh District*

# *Inside a* **40,000 Kva** *three phase*
# PENNSYLVANIA contour design
# LOAD RATIO CONTROL TRANSFORMER

40,000 Kva, Three Phase, 60 Cycles, 55°C. Temperature Rise. Forced-oil with forced-air heat exchangers. High voltage: 132,000 Grd.Y. Low voltage: 36,000 Y. Tertiary voltage: 13,650Δ (14,000 Kva). Low voltage windings provided with tap-changing underload equipment for plus and minus 10% regulation in 32-⅝% steps.

**Opening for load ratio control mechanism.**

**Upper Contour Design tank section fits over coil and core assembly and is welded to the bottom tank section.**

**Compartment for Preventive Auto Transformer.**

**Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.**

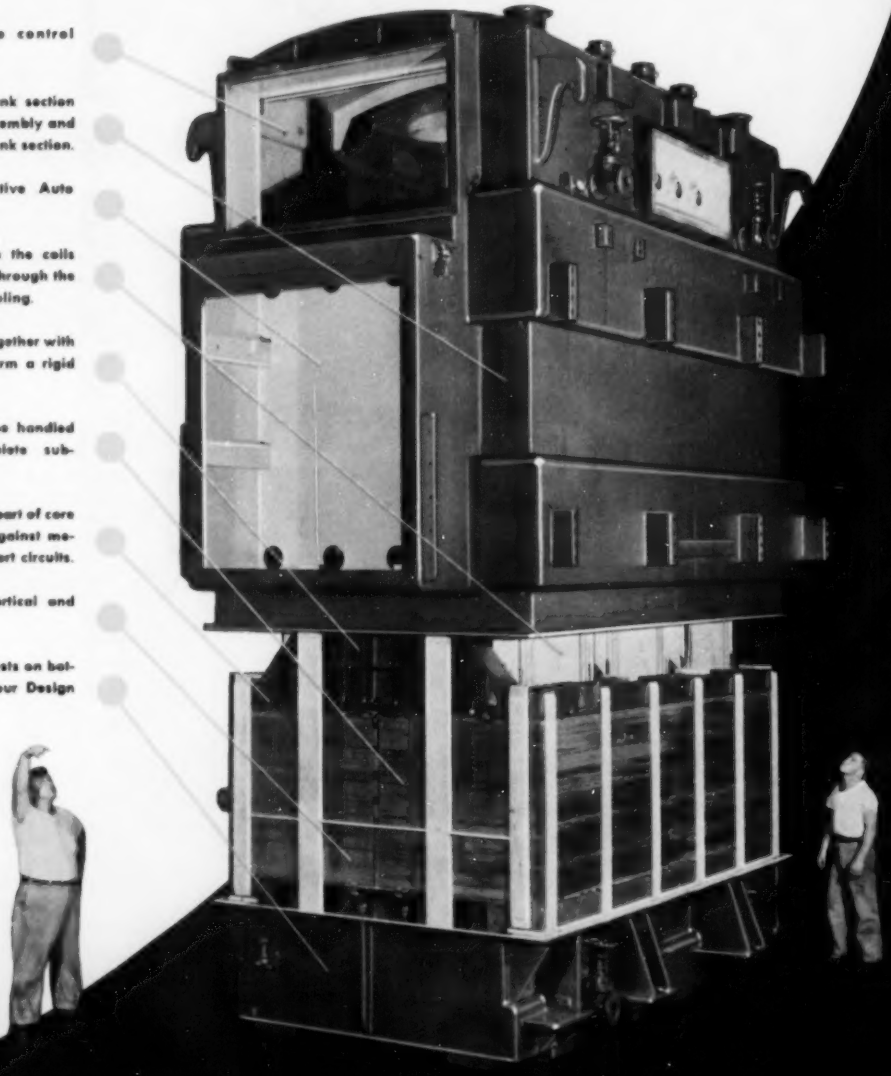
**Core and coils clamped together with heavy steel frames to form a rigid structure.**

**Core and coil unit can be handled separately as a complete sub-assembly.**

**Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.**

**Core cooled by both vertical and horizontal ducts.**

**Core and coil assembly rests on bottom section of the Contour Design tank.**



*for exterior view of this transformer*

*see other side*

**PENNSYLVANIA TRANSFORMER COMPANY**

*A McGraw Electric Company Division* • **CANONSBURG, PA.** • *Greater Pittsburgh District*

**graph** to photograph complex spectra found in new metals and materials. Request catalog D-272.

Cochrane Corp, Philadelphia, Pa., offers a **dalkalizer** which utilizes the ion exchange principal of salt splitting as a means of reducing alkalinity in boiler feed and process water. Ask for Publication 4567.

Bristol Motor Div, Vocaline Co of America, Inc, Old Saybrook, Conn., has a **high torque reversible motor** measuring 2 x 2 x 2 in. Torque is 5 in-lb at 1 rpm, 115 v, 60 cps . . . Industrial Instruments, Inc, Cedar Grove, N. J., offers the Type RN portable **Wheatstone bridge** as a completely gasketed unit to eliminate infiltration of wire or other metal particles to switch assemblies. It is available with or without Murray and Varley loops.

International Business Machines Corp, 590 Madison Ave, New York 22, N. Y., has a "one-man-force" **office machine** that performs operations involving several departments of office or plant (order writing or stock record accounting) at a centralized point. The entire set of related forms, tickets, and documents needed are produced simultaneously by one operator. An automatic computing unit permits calculations to be made, according to a preset program, on any job given to the machine.

M & W Electric Mfg Co, East Palestine, Ohio, offers complete packaged units for **service entrance** installations. Details in Catalog No. 55 . . . Canadian Marconi Co, 2442 Trenton Ave, Montreal 16, P. Q., Can., has a **photo-conductive cell** that handles up to 0.3 w to operate devices at voltages from 1.5 to 115 v . . . Broadway Maintenance Co, 22-09 Bridge Plaza N, L. I., N. Y., has a plastic **traffic marking compound** which dries within 30 sec. It is a durable compound designed for use in marking roadways, storage yards, parking lots, etc. . . . Swarthout Co, 18511 Euclid Ave, Cleveland 12, Ohio, offers an **amplifier-converter** which enables an all-electronic control to be used with thermocouples or other low-voltage dc inputs . . . Gibson Electric Co, Frankstown Ave, Pittsburgh 21, Pa., manufactures **electrical contacts** with low resistance, non-welding properties and long life.

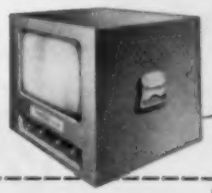
HERE'S an Employee who.....
Requires no pay check
Works 24 hours a day
Never makes a mistake
Never takes a vacation
Never wastes time

DIAMOND INDUSTRIAL (WIRED) TELEVISION

"UTILISCOPE" for special applications in heavy industry

"UTILIVUE" distributed by Graybar

Diamond Industrial Television has become an indispensable "employee" in many plants in a wide variety of industries. In their search for improved operation and lower costs, these companies have found the Diamond "Utiliscope" or "UtiliVue" the best answer to numerous problems. You, too, can probably use Diamond ITV to substantial advantage. For case histories and suggestions, return the coupon today.



7114

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO
OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment for Industry

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO

Please send me without obligation a copy of new bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs, improve quality, increase sales and aid safety.

Name_____

Company_____

Address_____

# Test

## your standard watthour meters rapidly & accurately with the

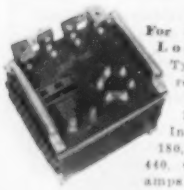
# KNOPP

**Uniload Rotating Standard Testing Equipment, Type RST-2**

Your portable standard watthour meters can be tested rapidly and accurately with the Knopp Uniload Rotating Standard Testing Equipment.

It has convenient controls. Calibrations of rotating standards at many load points and voltages are easy and accurate, because with the Knopp Uniload System (a) the single-range reference rotating standards receive through the medium of Knopp Precision Multirange Current and Potential Transformers exact known multiples or fractions of the selected test currents and voltages; (b) the reference standards need be used only on one current and voltage range and the standards always operate at full load and full rated-voltage; and (c) the precision multirange transformers always work at full excitation. Furthermore, the reference standards in this Uniload circuit cannot be subjected to over-voltage or over-current, thus adding to the reliability of performance.

Test voltages of 120, 240 and 480 are provided, and others are available if specified. There are twenty-four current ranges from .25 to 100 amps inclusive. Tests at power factors from unity down to 50% can be used.



**For Portable Use, Knopp Loading Transformer,** Type CL-5. Provides current for testing current-actuated and overload protective devices. Input voltages: 90, 110, 180, 220; or 180, 220, 360, 440. Output: 5 volts, 1000 amps; 10 volts, 500 amps.

**The Knopp Phase Sequence Indicator**—for 3-phase 3 wire and 2-phase 3-wire; 80 volts to 600 volts. Rotating Indicator shows sequence A-B-C or C-B-A. Light-weight, compact. Big time-saver.

*For complete technical descriptions, please write us today.*

KNOPP

*Electrical Facilities Inc.*

**4236 Holden St. Oakland 8, Calif.**


# Catalogs and Bulletins

● **CIRCUIT BREAKERS:** A 16-page booklet covers selection and application of DMB, low voltage, air circuit breakers. It also covers definitions of terms used in application of low voltage breakers, methods used in determining short circuit currents, a discussion of selective and cascade arrangements of breakers, and those portions of the National Electrical Code applying to low voltage circuit breakers. Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

● **RECORDER:** An oscillographic recorder which has a response up to 900 cycles is described in a new brochure. Technology Instrument Corp, Acton, Mass.

● **CLIP CONNECTORS:** Catalog Sheet No. 172 describes miniaturized alligator clips with vinyl plastisol sheath-type insulators. Mueller Electric Co, 1562G E. 31st St, Cleveland 14, Ohio.

● **MICROSCOPE:** Catalog D-15 describes the value of three-dimensional microscopes for industrial assembly lines. A selection guide is included. Bausch & Lomb Optical Co, 635 St. Paul St, Rochester, N. Y.

● **BRAZING MANUAL:** Describes application of major brazing methods in joining metals using silver alloys and filler metals, fluxes, and gas atmospheres. Tables, drawings and illustrations are included. Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.

● **METAL ALLOY:** A 32-page catalog describes and illustrates Alcaloy, an alloy of copper and aluminum which is non-sparking, non-magnetic and highly resistant to corrosion. Alcaloy Inc, Cleveland, Ohio.

● **ELEVATORS:** Folder No. HF-55 describes and illustrates power driven elevators of the continuous belt type with hand holds and steps at proper intervals to provide simultaneous up and down transportation without delay. Humphrey Elevator Co, Inc, Faribault, Minn.

● **TIMERS:** Descriptive and technical data, and wiring, dimension and housing information for interval timers are given in 8-page Bulletin PB-210. Bulletin PB-510 describes cycling timers. R. W. Cramer Co, Centerbrook, Conn.

● **PLATING:** Bulletin PP-100, 4 pages, lists electroplating and polishing equipment. Plating and cleaning processes and their applications are included. Hanson-Van Winkle-Munning Co, Matawan, N. J.

● **ATOM CONTROLS:** Folder ND46-70-700(1) describes control systems for nuclear reactors. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

● **THERMOCOUPLES:** Bulletin P1238 contains engineering data on selection and installation of proper types of thermocouples, wells, head assemblies, and other pyrometer accessories. Bristol Co, Waterbury 20, Conn.

● **FIRE TRUCKS:** A 12-page publication (Form CR-426-E) describes truck chassis for fire fighting and emergency applications. International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill.

● **SWITCHES:** The suitability of "telephone-type" stepping switches for a wide range of functions in computers is discussed in Bulletin RH6, 2 pages. Automatic Electric Sales Corp, 1033 W. Van Buren St, Chicago 7, Ill.

● **SERVO MOTORS:** Catalog No. 41, 36 pages, lists servo motors, motor tachometers and synchros as well as a line of special transformers for use with grid-controlled rectifiers. Servo-Tek Products Co, Inc, 1086 Goffle Rd, Hawthorne, N. J.

● **LIFT TRUCKS:** Bulletins 5111 and 5112 describe specifications and operation of electric, stand-up, hydraulic lift trucks. Yale & Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Pa.

● **INSULATION:** A 4-page folder lists comparative properties of Fiberglas-polyester general purpose grade electrical flat sheets with Phenolic grade CE. Another folder gives performance characteristics of various grades of Fiberglas-base sleeving and tubing. Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

● **PLASTICS:** Deflashing of thermosetting molded plastics at high speeds by means of automatic methods is discussed in a 4-page bulletin (No. 974). American Wheelabrator & Equipment Corp, Mishawaka, Ind.

● **ELECTRIC TOOLS:** Catalog FGH-2 describes grinders-millers, power quills, milling machines, drill presses, lathes and accessories. Precise Products Corp, 1328 Clark St, Racine, Wis.

● **ENGRAVER:** A 2-page folder illustrates and describes a series of hand engraving machines for lettering on metal name-plates. H. P. Preis Engraving Machine Co, 100 Industrial Branch, Hillside, N. J.

● **PIPE INSULATION:** "85% Magnesia Insulation Manual" contains 80 pages of text, illustrations and tables describing chemical and physical properties of hot piping insulation. Tables include thicknesses in which 85% Magnesia and diatomacious silica pipe insulation are manufactured and heat losses for a wide range of operating temperatures of pipe sizes and insulation thicknesses. State company and title when writing to Magnesia Insulation Mfrs. Association, 1317 F St, N.W., Washington 4, D. C.

● **MICROSCOPE:** "Philips 75 kv Electron Microscope" is the title of a 6-page folder that explains construction features of electron microscope. Research & Control Instruments Div, North American Philips Co, Inc, Mount Vernon, N. Y.

● **HEAT CONTROLS:** Bulletin P1260, 48 pages, contains specifications and engineering data for choosing proper furnace and oven control instruments. Bristol Co, Waterbury, 20, Conn.

● **UTILITY FANS:** A 24-page bulletin, No. DS-348U, describes advantages of belt-driven and direct-drive centrifugal fans, their construction, and special features for specific applications. Fan selection data, capacity tables for all sizes and types, roughing-in dimensions, and mechanical specifications are included. Write on firm letterhead to Trane Co, La Crosse, Wis.

● **PLASTICS:** "A Manual for Reinforced Plastics Tooling" is the title of a 20-page handbook containing drawings, diagrams and descriptions of uses for plastic tools, such as, spotting racks, checking and inspection fixtures, duplicate die molds, etc. Request on company letterhead from Marblette Corp, 37-21 30th St, Long Island City 1, N. Y.

● **LUBRICATION:** Field Report No. 140 is a "how-to" discussion on lubrication of engines and compressors, Alpha Corp, 65 Harvard Ave, Stamford, Conn.

● **HOSE:** Four catalogs cover a line of welding, steam, air and petroleum hose. They list recommended uses, construction, and specification as to size, weight, and recommended working pressures. Boston Woven Hose & Rubber Co, Box 1071, Boston 3, Mass.

*(More Catalogs & Bulletins on page 188)*

# DOW PRODUCTS

## GIVE ALL-AROUND BRUSH CONTROL ON RIGHT-OF-WAYS

## ESTERON Brush Killer and ESTERON 245 cut maintenance costs

A "crew" of Dow chemicals, used separately or as a team, will cut your maintenance costs to a new low. Esteron® 245 is highly effective for year-around brush control when used as a foliage spray or for basal bark and stump treatment. Esteron Brush Killer is widely used as a foliage spray for brush control.

In addition, Dow offers two new products to solve specific vegetation control problems. Kuron, new Dow brush killer containing silvex, has shown good results on post oak, blackjack oak, white oak, Northern pin oak and other oak species as well as red and hard maples. Where grass control is desirable in poleyards and around substations, Dow Dalapon Sodium Salt 85%, new *systemic* grass killer, is recommended. It can be used in combination with 2,4-D to control *both* broad-leaved weeds and grass. Ask your supplier how Dow products can cut your maintenance costs and help you get positive weed and brush control. Or write THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

*you can depend on DOW AGRICULTURAL CHEMICALS*

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power

QUICKLY Installed

TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO

Manufacturers of "THE ANCHOR OF MERIT"

FAIRFIELD, IOWA


## Catalogs

(*Continued from page* 186)

● **OIL SWITCHES:** Leaflets D11-25A, D12-26, D13-27 and D14-28 tell the story of typical installations of load break oil switches with automatic transfer mechanisms. G&W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

● **GE BULLETINS:** Following are available from General Electric Co, Schenectady 5, N. Y.:

**Control Devices.** Bulletin GEC-1260A contains wiring diagrams and dimensions of motor starters, contactors, relays, solenoids, switches, push buttons and pilot devices. Applications of manual and magnetic control, and across-the-line and reduced-voltage control are compared.

**AC-Motors.** Bulletin GEC-1026 gives buying and application information for standard ac fractional and integral hp motors in most general use. General- and definite-purpose fhp motors and gear motors are included.

● **WESTINGHOUSE BULLETINS:** Following are available from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.:

**Capacitors.** Bulletin B-6136 discusses capacitors for utility systems. It matches various capacitor applications on transmission and distribution systems to the capacitor unit for the job.

**Power-Line Carrier.** Bulletin 84-400 describes construction, operation and application of this equipment.

**Induction Heating.** Booklet B-6519 describes application of induction heating equipment in metal working.

**Audio Amplifier.** Bulletin 85-950 describes the type FG 5- or 10-kw variable frequency audio amplifier.

● **TRANSFORMERS:** Standard Bulletin S-401-B, 11 pages, describes single-phase, oil-filled distribution transformers rated from 480 v to 34.5 kv. Weights, dimensions, connection diagrams and NEMA ratings are given. Standard Tranformer Co, Warren, Ohio

● **CAPACITORS:** Catalog K55, 16 pages, gives descriptions, ratings, dimensions and application information for power factor correction capacitors. Indoor, outdoor and pole-type capacitors are included. Ratings from 230 v to 13.8 kv. Electrical Utilities Co, La Salle, Ill.

● **CABLE TROUGH:** Expanded metal cable trough and fittings with built-in couplers are described and illustrated in Bulletin 67A, 12 pages. Dimensions, application details and load deflection data are included. T. J. Cope, Inc, 711 S. 50th St, Philadelphia 43, Pa.

● **ELECTRICAL FITTINGS:** A line of conductor fittings and devices are described in an 80-page catalog. Features, dimensions and specifications are given. A pictorial index is included in HV-10-280. Hi-Voltage Equipment Co, 4000 E. 116 St, Cleveland 5, Ohio.

● **BUSHINGS:** A complete line of dry-type assembled bushings for electrical apparatus is described in Bulletin No. 443, 16 pages. It lists ratings, dimensions and specifications for primary and secondary applications up to 287.5 kv. Lapp Insulator Co, Inc, Le Roy, N. Y.

● **INSULATOR:** Descriptions of construction, and electrical and mechanical characteristics of a station post apparatus insulator are given in Bulletin LA 106, 4 pages. Locke Dept, General Electric Co, Baltimore, Md.

● **COOLING TOWERS:** A 30-page brochure contains illustrations and descriptions of induced draft cooling tower construction, operation and installation. J. F. Pritchard & Co, 4625 Roanoke Parkway, Kansas City, 12, Mo.

● **HEAT INSULATION:** A 16-page booklet describes "Marinite", a structurally strong sheet material which builds and insulates. Handling and working recommendations, construction and fabrication suggestions, and data on physical and thermal properties are included. Johns-Manville, 22 E. 40th St, New York 16, N. Y.

## *Technical Literature*

**NEMA Standards**—Following are available from National Electrical Manufacturers Assn, 155 E. 44th St, New York 17, N. Y.:

● TR1-1954 Transformers. Mimeographed pages dated April 13, 1955 contain the latest revisions for this standard.

● CT1-1955 Commutators. Covers conventional steel and mica commutators with a diameter of 3 in. and less at the brush track and intended for use with electric motors and generators having Class A or B insulation. Price $1.50.

● IC2-1955 Resistance Welding Control. Contains information on terminal markings and connections, enclosures, contactors, types of controls, timer ranges and accuracies, slope control, and symbols and device designations. Price $3.00.

**Relays**—All aspects of relays are covered in 23 technical papers presented at the Third National Conference on Electromagnetic Relays held in March, 1955. 70 pages. Write on company letterhead to Potter & Brumfield Mfg Co, Inc, Princeton, Ind.

**AIEE Standards**—Following are available from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.:

● C37.6-1955 Schedules of Preferred Ratings for Power Circuit Breakers—6 pages. Price 40¢.

● C57.13 Requirements, Terminology, and Test Code for Instrument Transformers—69 pages. Price $2.50.

● AIEE No. 45, Mar. 1955 Recommended Practice for Electric Installations on Shipboard—160 pages. Price $3.50.

**ASTM Standard**—Electrical Insulating Materials (with related information). Includes the latest ASTM methods of testing along with specifications for insulating materials. Four appendices discuss: Significance of tests of materials; recommendations for writing statements as to usefulness of tests; and proposed methods of test for dielectric constant and dissipation factor for pasted mica used in electrical insulation. 660 pages. Price $5.50. American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

**Overload Relays**—Testing current actuated protective devices is discussed and illustrated in a 2-page bulletin. Included is a technique for running speedy performance checks on motor starter overload relays to determine trip times. Multi-Amp Corp, 10 Third St, Newark 7, N. J.

**Lighting Standards**—The 1955 edition of RLM Standard Specifications for Industrial Lighting Units covers 46 types and sizes of incandescent and fluorescent units. It contains details of construction, operation, efficiency, and tables and charts of lighting distribution. RLM Standards Institute, Suite 818, 326 W. Madison St, Chicago 6, Ill.

**Fire Equipment**—The 1955 edition of the Fire Protection Equipment List is now available from Underwriters Laboratories, Inc, 161 Sixth Ave, New York 13, N. Y.

Handling records . . . your records . . . is the single intended purpose of the Diebold Motorized Elevator File. Regardless of the number of meters or equipment you regularly service, read, install, bill or merely "keep track of," here's a motorized file unit that will bring each record to an operator's finger tip at the touch of a button . . . in an average of 3 seconds or less.

## METERS, METERS EVERYWHERE . . .

Volume and record activity will determine your choice of the "Standard" and "Super" ELEVATOR FILES available. Unit capacities range from 16,000 to 300,000 records. Users report savings up to 50% in time . . . and another 50% in space. In addition, they report improved record controls and the reduction of operator fatigue. For complete information on new low-cost record keeping efficiency, call your local Diebold representative, or mail this coupon today.

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Please send complete information about low-cost record-keeping with motorized Diebold Elevator Files.

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Individual _____ Title _____

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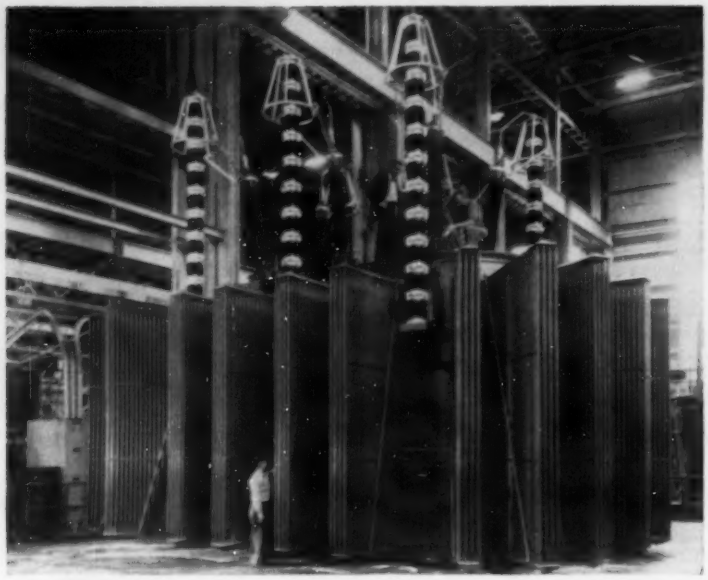
# MANUFACTURERS AND MARKETS



## GE Ships It's Largest Reactor

General Electric Co recently finished testing and shipped a 270,000-lb, 56,000-kva, oil-immersed current-limiting reactor, said to be the largest ever built by the company. The reactor was purchased by Ebasco Services, Inc. for the Joppa (Ill.) Steam Electric Station of Electric Energy Inc., a combination of utilities supplying power to an atomic energy installation at Paducah, Ky.

The unit will be used as a tie between two 161-kv buses to reduce the current which would flow from one part of the system to another during a short circuit. It is designed to withstand a short-circuit current of about 7,200 amp for 5 sec, although under normal operating conditions, its load is 56,000 kva at 1,200 amp.

Design of the reactor is unusual in that the three phases of the unit are mounted side by side in an oval shaped tank instead of the normal mounting of one above the other within a round tank. This was said to be necessitated by the size of the unit. To help prevent overheating during a short circuit, the three windings are surrounded by an aluminum shield which forms a tank within the tank.

The reactor is self-cooled by 22 radiators on the tank circumference. Protection on both sides is provided by six integrally mounted lightning arresters rated 133 kv. It has an over-all height of 25 ft and requires a floor area of about 20 by 32 ft. Oil capacity is 18,100 gal weighing 135,000 lb.

## Westinghouse to Install UNIVAC System

Westinghouse Electric Corp. will install UNIVAC, the electronic data processing system, at its East Pittsburgh plant sometime this summer, according to L. B. McCully, vice president in charge of the East Pittsburgh divisions. Initially, the unit will be used for payroll computations. Later it is planned to "feed it" other problems related to clerical operations and management control procedures.

The giant computing system, built by Remington Rand Inc., will be installed in a new building to be constructed near the East Pittsburgh administrative offices, McCully said. When the building is completed, about six weeks will be required to install and test the equipment. The UNIVAC consists of five major parts, occupying about 3,000 sq ft of floor area.

## C-E's Steam Generator Features Monotube Design

An innovation in American steam power practice was disclosed recently by the placement of a contract with Combustion Engineering, Inc, of New York, for a C-E Sulzer Monotube steam generator. The unit was ordered by Dayton Power & Light Co.

This steam generator according to C-E, will be the first of the "once-through" type to operate at a steam pressure in the "sub-critical" range.

The unit is to be installed in the Frank M. Tait Station in Dayton where it will serve a 125,000-kw turbine-generator. It will supply steam at a pressure of 1,800 psig, with a primary steam temperature of 1,000 F, and a reheat temperature of 1,000 F.

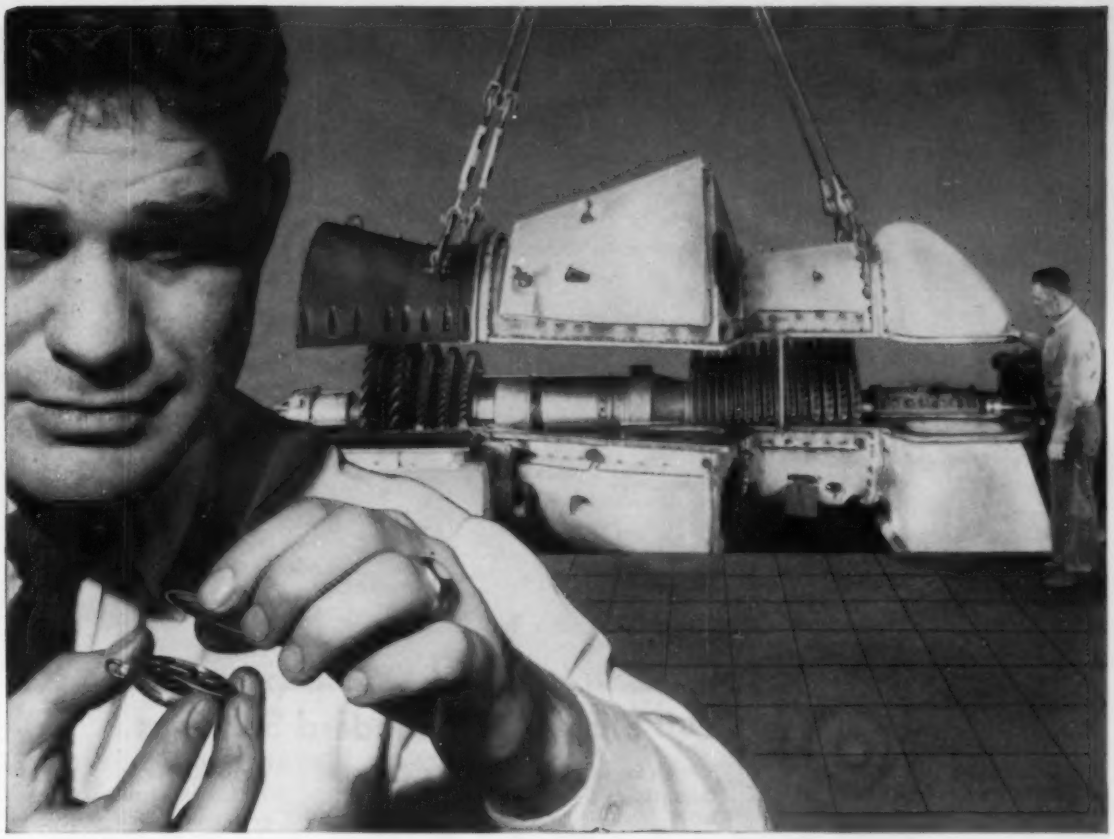
This C-E Sulzer unit is the second to be ordered in this country. The previous unit, ordered last year by Philadelphia Electric Co, is designed for the "super-critical" pressure of 6,000 psig, the highest steam pressure adopted to date. Steam temperature for this unit, 1,200 F, is reported also to establish a new record. Only one other "super-critical" pressure boiler has thus far been ordered in America, and there are none installed abroad, according to C-E.

## IRE President Tells of New Concepts

In a speech delivered at the recent Institute of Radio Engineers' convention in New York, IRE president, J. D. Ryder, discussed the relationship between electrical education, electronics and the IRE. He pointed out that the effect of our economy changing from one based on raw material to one based on manufactured goods, has been to lessen the importance of certain types of engineering.

Ryder described the electronics engineering field as the one best geared to our new economy. The ability of the electronics industry, he said, has been broadened by the addition of new fundamental concepts to those contributed by such men as Ampere, Coulomb, Faraday, Maxwell, and others. The concepts he described are:

(*Continued on page* 192)



**FACTS on Westinghouse 5000-kw gas turbines . . .**

# Opens for inspection like a fine watch

Westinghouse gas turbines split down the center line to give you these advantages:

- Turbine and compressor are exposed for inspection and service by lifting one light cover.
- Lifting the cover does not disturb the bearings or the rotor alignment.
- No extra space is needed around the turbine for opening it—the cover is lifted straight up to take it off.

The center-line-split design of Westinghouse gas turbines saves maintenance dollars, saves on lifting equipment and saves building expense. It is the same basic design that has been used on Westinghouse steam turbines for over 50 years because it gives utilities the ease of maintenance they want. It provides the easiest, safest and quickest way to open a turbine.

**GET ALL THE FACTS** about easy maintenance of a gas turbine. Call *The Man With The Facts,* your Westinghouse sales engineer, or write for a copy of booklet B-5887, *Westinghouse Gas Turbine Power Plants for Electric Power Generation.* Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-50573

**GAS TURBINE POWER PLANTS FOR ELECTRIC POWER GENERATION . . . 1250 KW TO 15,000 KW**

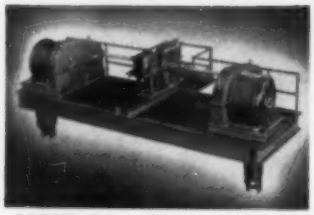
YOU CAN BE **SURE** . . . IF IT'S

Westinghouse

Washington Water Power Co.
Cabinet Gorge Project
Clark Fork River, Idaho

*When you plan...*

**POWER DAM GATES**



**MURCO GATE HOISTS**
*for any Size Power Dam*

**ask us about design and patterns that may help you . . .**

In planning gates or gate hoists, you may save time and money if you will write us before your over-all plans are complete . . . In over seventy years of designing and building power dam gates and gate hoists, we have developed designs for many gate and gate hoist problems. For that reason, we may have designs and patterns that will fit your special requirements. MURCO gate hoists are designed and built in a wide range of capacities, from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

We also build gate hoists to fit your plans and specifications. Write for complete information and Engineering Department recommendations.

MURCO
D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883
WAUSAU • WISCONSIN

## IRE President

(*Continued from page* 190)

Development of theory of the electric circuit as a working tool, not as just a pair of wires connecting source and load; the mathematical statement underlying feedback, old in principle, but new in precision and broad application; and the removal of the restrictions of linearity by advances made by mathematically-inclined IRE members.

## O-B Ships ASA Standard Bushings

With the first shipment, on April 15, of three Type LK-30 bushings (69 kv), Ohio Brass Co officially placed its line of ASA Standard bushings in the field. Work is underway to build adequate stocks to permit immediate shipments on new orders.

The present group of O-B ASA Standard bushings covers ratings of 23, 34.5, 46, and 69 kv. Facilities will soon be completed for the manufacture of bushings covering all operating requirements. (EW, Feb. 28, 1955, p 56).

## Solar Battery Efficiency Increased

Efficiency of the solar battery has been practically doubled, according to Bell Telephone Laboratories. The initial efficiency of 6% has been raised to 11%, a figure which is said to be comparable to that of the best gasoline engines and 20 times higher than that of the best photovoltaic devices.

The Bell battery is made of wafers of especially prepared silicone, a semiconducting material that is extremely sensitive to light. Improved wafers can now be electrically linked together to deliver power from the sun at a rate of up to 100 w per sq yd of silicone surface. Higher efficiency is a result of refinements in the fabrication process aimed at reducing internal losses in the individual cells.

Trial models of the improved battery will have their first practical test this summer in Americus, Ga. Here experiments will determine its usefulness in supplying power to amplifier stations on rural telephone lines.

(*Manufacture's Briefs on page* 194)

*Outdoors, indoors, mercury-vapor lamps are subject to the effects of vibration.*

## Here's where new

# SYLVANIA

## RUGGEDIZING PAYS OFF

Now Sylvania engineering adds another important extra to the long-service characteristics of mercury-vapor lighting—rugged, vibration-resistant construction—for extra dependability under severe working conditions.

In new ruggedized Sylvania mercury lamp design—Sylvania engineers have cast aside the old-fashioned method of tab-mounting resistors. "Too vulnerable to vibration," they said. Straight-through mounting and *wrapped welds* now give resistors in Sylvania mercury lamps the ruggedness that means extra service: greater economy.

Make it a point to order Sylvania mercury-vapor lamps—and see for yourself how ruggedizing pays off. For details, contact your Sylvania supplier today.

---

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Salem, Mass.
*In Canada:*
*Sylvania Electric (Canada) Ltd.*
*University Tower Building, Montreal*

**STRAIGHT-THROUGH RESISTOR MOUNT**

in Sylvania mercury-vapor lamps now adds new stability where vibration used to be a primary trouble source.

# SYLVANIA®

**... fastest growing name in sight**

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

# 4-wheel drive does another job better!

LINE CONSTRUCTION

Good road, bad road or no road — it's all the same to the Universal 'Jeep.' Its go-anywhere 4-wheel-drive and maneuverability put the 'Jeep' in a class by itself—a stop-at-nothing vehicle you can rely on to take men and tools where they are needed. When there's work to be done off the highway, the 'Jeep' is indispensable. See your nearest Willys dealer or write for information.

4-WHEEL-DRIVE UNIVERSAL 'Jeep'®

A member of the 'Jeep' family... world's largest-selling 4-wheel-drive vehicles

*Willys Motors, Inc., Toledo 1, Ohio*

# PAGE chain link FENCE

America's First Wire Fence—since 1883

• When next you need fence as protection against common hazards you certainly will want time-tested quality in the safeguard you provide. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

*Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.*

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.


## Manufacturer's Briefs

**Minneapolis-Honeywell Regulator Co** of Philadelphia, Pa., has been awarded a contract to produce monitoring and recording devices for the control system of the chemical processing plant at the Atomic Energy Commission's National Reactor Testing Station at Idaho Falls, Idaho. The contract is in excess of $58,000.

**Carrier Corp and Affiliated Gas Equipment, Inc.,** obtained approval for a merger of Affiliated into Carrier at recent stockholders' meetings of both companies, according to Cloud Wampler, president and chairman of Carrier. Combined sales of both companies were over $200 million in 1954. Total assets are $130 million.

**Cutler-Hammer, Inc.** of Milwaukee, Wis., will soon start construction of a new plant in Los Angeles, Calif. The 32,000 sq-ft building will combine assembly and manufacturing facilities for electric controls. The company hopes to start operations in the building by the end of 1955.

**Remington Rand's** new Univac II computer has double the speed and capacity of the current model, according to John E. Parker, vice president. Along with the latest electronic developments, Univac II contains a magnetic core memory system. This expanded high-speed system is capable of retaining 24,000 characters while executing instructions at the rate of 8,000 per min.

**Peerless Electric Co.** of Warren, Ohio, will break ground this month for a $350,000 plant to house its fan and blower division, stated Ralph Kroehle, president. Construction is set for completion by Sept. 1 and operations are scheduled to begin about Dec. 1.

**Panellit, Inc.** of Chicago, Ill., has acquired Jordan Electronic Mfg. Co., Inc., according to Albert F. Sperry, president of Panellit. The former manufactures automatic control and data reduction systems and Jordan produces radiation monitoring equipment. It is planned to operate Jordan as a wholly owned subsidiary of Panellit, with M. Jordan Nathason, the former owner, serving as president and Albert Sperry as chairman of the board. Panellit is constructing a new

plant in Alhambra, Calif. The first unit of 10,000 sq ft is expected to be ready for occupancy some time in May.

**Monsanto Chemical Co** at Springfield, Mass, has established an industrial applications department, with Thomas A. DeMarco as Manager. The new department will aid end-users in the specification of plastic materials.

**International Business Machines Corp** is planning to shift the entire assembly, and a portion of its parts production, of electric typewriters from Poughkeepsie, N. Y., to Kingston, N. Y. Ground will be broken at Kingston this summer for a 322,000 sq ft plant which will be solely devoted to electric typewriter manufacture. Vacated space at Poughkeepsie will be used for IBM's expanded electronic data processing machine manufacturing program.

**McGill Manufacturing Co** of Valparaiso, Ind., is observing its 50th anniversary. The firm is headed by Charles S. McGill, president, and Robert A. McGill, vice president. Both are sons of the company founder, James H. McGill. Products are 3-wire, grounded portable lamp guards with or without convenience outlets, and lever-operated switch mechanisms for lampholders, also roller and ball bearings.

**General Dynamics Corp** plans to merge with Stromberg-Carlson Co subject to approval by stockholders of both firms on June 28. Merger would be affected by a share-for-share exchange of stock. General Dynamics would be the surviving company.

**International Nickel Co** of New York has revealed its new copper smelting process that reduces costs and produces a furnace gas for making liquid sulphur dioxide and sulphuric acid. Under development since 1945, the process has completed one year of operation and the company has delivered more than 250 million pounds of refined copper in 1954.

**Hoffman Engineering Corp** of Anoka, Minn., has completed the addition of 10,000 sq ft to manufacturing facilities for its line of JIIC oil-tight pull boxes, troughs, push button stations and NEMA 12 panels.

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# Empire District Electric Makes Changes

D. C. MCKEE

E. J. DREWELOW

Empire District Electric Co has elected D. C. McKee chairman of the board, succeeding James E. Harsh who has retired. McKee will continue as president. Earl J. Drewelow, in addition to being a vice president, took over McKee's position as general manager. Frank H. Shelton, treasurer and assistant to the president, became vice president and treasurer.

McKee joined the company in 1920 as a member of the engineering department in Joplin. He was elected president of Empire District Electric in 1948.

Drewelow has a background of 31 years experience in electric utility operations, the last 28 being with the company. He was elected a vice president in 1951 and placed in charge of operations.

Shelton joined the company in 1923 as construction engineer and construction superintendent for the Riverton steam plant. In 1949 he became assistant to the president of the company.

## Davis Becomes Asst General Manager

Toledo Edison Co has elected John K. Davis vice president and assistant general manager of the company.

Davis, who has been vice president and a director of the company since 1949, joined the company in 1946 as director of personnel. Previously he had been associated with the East Tennessee Power & Light Co as an electrical engineer, division superintendent and later as division manager before being called to active duty as a captain in 1942. He served as a lieutenant colonel on Gen Douglas MacArthur's staff until his release in May, 1946.

J. K. DAVIS

G. F. WATTERS

## Watters Upped to Executive VP

Niagara Mohawk Power Corp has elected Gustav F. Watters executive vice president. Previously he had been a vice president and director of the company.

Watters started working for the system in 1935 in the appliance service department in Buffalo. He was made assistant to the vice president of the Niagara, Lockport & Ontario Power Co in 1940. After serving in the Army in World War II, he was named assistant vice president of the Buffalo Niagara Electric Corp in 1945. He became vice president and director of Niagara Mohawk in 1950.

(*More News About People on page* 198)

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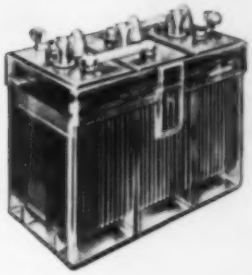

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## Two New VP's Made at Westinghouse

C. H. BARTLETT

C. C. SHUTT

Operating heads of two divisions have been made vice presidents of the Westinghouse Electric Corp. They are Chris H. Bartlett, who directs the 39 shops and plants of the Manufacturing and Repair Division at Pittsburgh, and Charles C. Shutt, head of the Small Motor Division at Lima, Ohio.

Bartlett, after training in sales for the company, joined the Transformer Division Sales Department. In 1944 he was named manager of the instrument and specialty department sales. In 1954 he was named manager of the Manufacturing and Repair Division.

Shutt became a section engineer in the Generator Division at East Pittsburgh. In 1938 he was transferred to the small motor division as manager of the company's engineering department and two years later he was named manager of the division.

## Schudt Named Canadian A-C President

H. M. SCHUDT

Canadian Allis-Chalmers, Ltd, has elected Harold M. Schudt president, succeeding Mark C. Lowe, resigned.

Schudt came to Allis-Chalmers Manufacturing Co in 1929 while a student engineer at Marquette University from which he graduated in 1932.

In 1946 he was named a special representative for the division's export department and spent two years in England for the company. He returned to the U. S. in 1948 and was named general manager of company's Gadsden, Ala., works. He was made director of engineering in 1954.

## Harvey Hubbell Adds Another VP

George R. Weppler, formerly vice president of operations at the Waterman Pen Co at Seymour, Conn., has been elected vice president and assistant general manager of Harvey Hubbell, Inc, Bridgeport, Conn.

Prior to his service with the Waterman company, he was manager of operations of Metal & Thermit Corp, New York City, and before that, general production manager and director of Johnson & Johnson, Industrial Tape Corporation.

He is a member of the American Management Association and the American Ordnance Association.

G. R. WEPPLER

## PERSONAL BRIEFS

**James Q. Wray, Jr,** formerly assistant chief engineer-design of the Pennsylvania Water & Power Co and Safe Harbor Water Power Corp, has joined Duke Power Co as assistant to the chief engineer . . . Electric Bond & Share Co has elected as director **Frederick C. Gardner,** president of Ebasco Services Inc . . . **Hance H. Cleland** has ended active association with the San Diego Gas & Electric Co, of which he was both former president and former chairman of the board. He retired as a director in 1953. Since that time he has been a consultant and has administered the company's military leave program.

Cincinnati Gas & Electric Co has elected as director **Samuel M. Hammill, Jr,** vice president in charge of the electrical department . . . Montana Power Co has named **Walter H. McLeod** and **Dean Chaffin** directors . . . **Don S. Campbell** has been appointed Chief of the Bureau of Reclamation's Power Division in Washington, D. C. He had been regional supervisor of power in USBR's Boise, Ida., office.

## OBITUARY

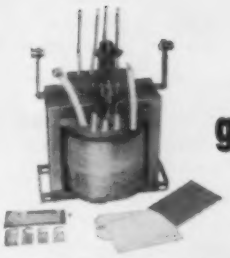
**Allen Hollis,** 83, president of the Concord Electric Co and the Exeter & Hampton Electric Co for the past 50 years, died at Concord, N. H., on April 26. He was also a director of the Public Service Co of New Hampshire.

**Thomas Henry Elder,** 59, assistant director of the High Point, N. C., Department of Public Utilities, died in High Point recently.

**Eugene F. Roan,** vice president of the Harveys Lake Light Co, died on April 23 at his home in Forty Fort, Pa.

**Floyd A. Beaty,** 66, vice president and director of the Iowa Power & Light Co, died in Des Moines on April 23. He had started with a predecessor company in 1913.

**Cassius W. Bashore,** 62, superintendent of overhead lines for the Indianapolis Power & Light Co, died on April 23. He joined the company in 1932, later becoming night supervisor of operations. He held his last post since 1945.

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# MEETINGS CALENDAR

**An extended list of coming meetings appears in the last issue of each month.**

## MAY

**EDISON ELECTRIC INSTITUTE** — Electrical Equipment Committee, Rice Hotel, Houston, Tex., May 16-17; Financing and Investor Relations Committee, Hotel Roosevelt, New York, May 19; Industrial Relations Committee jointly with Personnel Administration Section, Southeastern Electric Exchange, Netherlands Plaza Hotel, Cincinnati, May 19-20; Dealer Coordination Workshop, Webster Hall Hotel, Pittsburgh, Pa., May 19-20; Sales Personnel and Training Committee, EEI Headquarters, New York, May 26-27.

***AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS** — National Telemetering Conference, Morrison Hotel, Chicago, May 18-20; Switchgear & Subcommittees Meeeting, Hotel Hershey, Hershey, Pa., May 19-20; Sixth Annual Appliance Technical Conference, Hollenden Hotel, Cleveland, May 23-24.

**NORTHWEST PUBLIC POWER ASSOCIATION** —Engineering and Operations Section, Monticello Hotel, Longview, Washington, May 19-20.

**PENNSYLVANIA ELECTRIC ASSOCIATION**—Spring Meeting, Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, May 19-20; 1955 Annual Industrial Sales Conference, Bedford Springs Hotel, Bedford, Pa., May 19-20; Annual Accounting Conference, William Penn Hotel, Pittsburgh, May 23-24; Spring Meeting, Relay Committee, Abraham Lincoln Hotel, Reading, Pa., May 26-27.

**INTERSTATE POWER CLUB**—General Electric Co. Wire and Cable Plant, Bridgeport, Conn., May 20.

**NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS**—47th Annual Convention, Conrad Hilton Hotel, Chicago, Ill., May 22-25.

**ATOMIC INDUSTRIAL FORUM**—May Meeting, Waldorf-Astoria Hotel, New York, May 23-24.

***AMERICAN MANAGEMENT ASSOCIATION**—Hotel Roosevelt, New York City, May 23-25.

**NORTH CENTRAL ELECTRICAL ASSOCIATION** —Accounting Committee, Fergus Falls, Minn., May 27-28.

## JUNE

***NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS**—Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, June 2-4.

***CONTROLLERS INSTITUTE OF AMERICA**—Mid-Western Regional Conference, Hotel Radisson, Minneapolis, June 5-7.

**AMERICAN WELDING SOCIETY**—Spring Meeting and Welding Show, Hotel Muehlebach and the Kansas City Auditorium, Kansas City, Mo., June 7-10.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS**—Oil and Gas Power Conference, Statler Hotel, Washington, D. C., June 5-10; ASME-IME Comb. Conference, MIT, Boston, June 15-17; Applied Mechanics Conference, Rensselaer Hotel, Troy, New York, June 16-18; Diamond Jubilee Semi-Annual Meeting, Statler Hotel, Boston, Mass., June 19-23.

**ILLUMINATING ENGINEERING SOCIETY**—Northwestern Regional Conference, Ft. William Henry, Lake George, N. Y., June 10-11.

**ELECTRIC COMPANIES ADVERTISING PROGRAM**—Management Group, Statler Hotel, Los Angeles, Calif., June 12.

***AMERICAN SOCIETY OF REFRIGERATING ENGINEERS** — 42nd Semi-Annual Meeting, Hotel Schroeder, Milwaukee, Wisc., June 12-15.

**EDISON ELECTRIC INSTITUTE**—23rd Annual Convention, Los Angeles, Calif., June 13-16.

**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS**—Magnetics Conference, Hotel William Penn, Pittsburgh, June 14-16; Summer General Meeting, New Ocean House, Swampscott, Mass., June 27-July 1.

**AMERICAN SOCIETY FOR ENGINEERING EDUCATION**—63rd Annual Meeting, Pennsylvania State University, State College, Pa., June 20-24.

**NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION**—Accounting and Business Practice Section, Vancouver Hotel, Vancouver, B. C., June 22-24.

**WISCONSIN UTILITIES ASSOCIATION**—Accounting Section, Dell View Hotel, Lake Delton, Wis., June 26-28.

**MICHIGAN ELECTRIC ASSOCIATION**—Annual Convention, Grand Hotel, Mackinac Island, Mich., June 26-29.

**AMERICAN SOCIETY OF TESTING MATERIALS**—1955 Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26-July 1.

**CANADIAN ELECTRICAL ASSOCIATION**—Annual Convention, Hotel Vancouver, Vancouver, B. C., June 27-29.

* Additions this week.

## Metal-Enclosed Sub

(*Continued from page* 105)

protected by variable percentage ratio differential phase relays in conjunction with magnetizing inrush desensitizers. Sudden-pressure and thermal relays are provided on the transformers.

**4.** There is no separate protection for the 69-kv buses as transformer differential relays and line relays cover all sections.

**5.** Primary protection for both initial 69-kv lines consists of pilot wire relays, together with the necessary interlock and supervisory devices. Back-up protection for the two lines is different as one line is so short that product type ground relays could not be applied. On the Brunot Island line, reactance type phase and product type ground relays with the necessary instantaneous overcurrent interlock devices are used. For the short line, protection is the same except a second set of pilot wire relays are used instead of product type ground relays.

All relaying is set up for three 69-kv lines despite the fact that one line will be installed later than the other two. Temporary jumpers by-pass extra relays until the third line is ready, a measure that will minimize outage time during this change. As the station will be the only source for a considerable part of the downtown area, prolonged 69-kv outages are highly undesirable.

## Streamflows Relieve Power-Pinched NW

Improved streamflows on the Columbia River and the addition of new generating units have prompted Bonneville Power Administration to up its interruptible energy deliveries to 95% of normal for 14 industrial plants curtailed in March-April.

In addition to the start of the Columbia River spring runoff, 110,000 kw of new federal generating capability, placed on the line April 28, helped ease the power-short situation. A 70,000-kw unit at McNary Dam and a 40,000-kw unit at Lookout Point Dam were pushed into service weeks ahead of the June schedule.

With a rapid increase in spring runoff expected, adequate power supply seems assured until fall.

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# Foes Attack D-Y

## Radin calls contract symbol of attack on public power; Gore deplores Ebasco's role

Proposed Dixon-Yates plant to supply power to Tennessee Valley Authority drew fire on two fronts in Tennessee recently—the Tennessee Valley Public Power Association convention in Memphis and the annual meeting of the Tennessee Municipal League in Nashville.

Alex Radin, general manager of the American Public Power Association, in his address before the TVPPA members, pointed up the Dixon-Yates contract as a symbol of attack against public power systems.

"The Dixon-Yates contract," he declared, "is but one example and a symbol of a nationwide campaign which is being waged by private power interests to cripple or eliminate many public power systems.

"Though the private interests contend their campaign is directed only against the federal power program, the evidence is abundant that the municipally owned systems, public utility districts, state-owned utilities and rural electric co-operatives likewise are being subjected to this attack."

Radin also urged the association to support legislation introduced by Sen Albert Gore (D-Tenn.) which would authorize the Atomic Energy Commission to construct a large-scale reactor at Oak Ridge, Tenn.

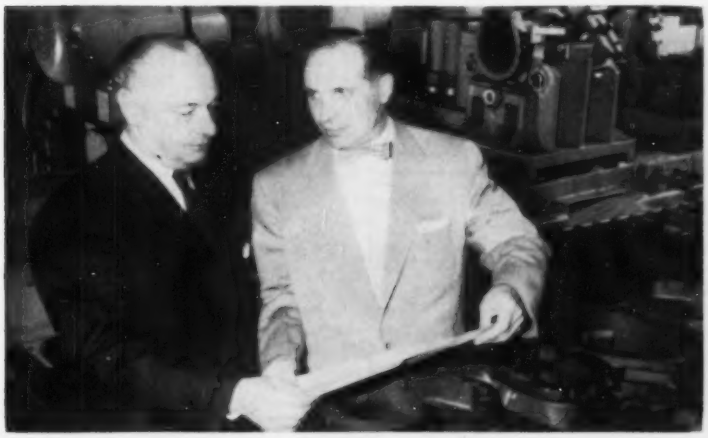
While attending the Tennessee Municipal League meeting as a speaker a few days later, Senator Gore attacked the "Dixon-Yates crowd" for hiring Ebasco Services, Inc, to build its West Memphis plant. He expressed regret that no way exists for Congress to force Ebasco to pay back "its millions of dollars in excess charges" (for the Electric Energy, Inc, plant at Joppa, Ill.).

"After all it could only be expected that Dixon-Yates would do just what it did. The two concerns have the same address just off Wall Street," Gore added.

Delegates to the TVPPA convention re-elected J. F. Perry of Clarksville, Tenn., as president.

### *Dixon-Yates Bids Open*

Bids for construction of the Dixon-Yates steam generating plant near West Memphis, Ark., will be opened this week at Ebasco Services, Inc, offices in New York. Plans and specifications already have been released to prospective bidders. About 25 contracts will be awarded for the $107-million, three-unit plant, it was reported.



# New Heat Pump and A-C Plant Opened

New heat pump and air conditioning plant, recently opened by Westinghouse Electric Corp at Staunton, Va., is shown above being inspected by H. E. Seim, vice president of the company, and John A. Gilbreath, Air Conditioning Division manager. At the plant's formal opening, the two executives announced Westinghouse plans to step up promotion of the heat pump.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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## BLACK & VEATCH

*Consulting Engineers*

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuations and Rates

4706 Broadway — Kansas City 2, Missouri

## THEODORE D. BROSS & COMPANY

Steel Tower & Wood Transmission Lines

*Distribution & Maintenance*

175 Enfield St. — Hartford, Conn.

## DAY & ZIMMERMAN, INC.

*Engineers*

Design - Construction - Management
Investigations and Reports

New York — Philadelphia — Chicago

## Doble Engineering Company

***Electrical Insulation Engineers***

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

## ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

## ROBERT E. FOLEY CONSTRUCTION CORPORATION

Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. — Binghamton, N. Y.

## FORD, BACON & DAVIS

*Engineers*

DESIGN • CONSTRUCTION
VALUATIONS •• REPORTS

New York • Chicago •• Los Angeles

## GILBERT ASSOCIATES, Inc.

***Engineers • Consultants • Constructors***

Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
Industrial Relations • Purchasing

New York — Philadelphia — Washington
Rome — Manila — Medellin

## HARZA ENGINEERING CO.

*Consulting Engineers*

Calvin V. Davis — R. Montford Fuchs
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street — Chicago 6

## HOOSIER ENGINEERING COMPANY

*Erecting Engineers*

*Transmission Lines, Substations*

1384 Holly Avenue, Columbus, Ohio

## S. E. HUEY & CO.

*Engineers & Surveyors*

SURVEYS FOR ENGINEERS

Monroe — Louisiana

## JACKSON & MORELAND

*Engineers and Consultants*

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston — New York

## M. W. KELLOGG

*Piping System Design Analyses*

Unique piping system model tester as well as modern IBM card programming computer available for low cost, accurate analyses of the most complex piping systems.

The M. W. Kellogg Company,
225 Broadway, New York 7, N. Y.

## THE KULJIAN CORPORATION

*Engineers - Constructors - Consultants*

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)

Utility • Industrial • Chemical

1200 N. Broad St., — Philadelphia 21, Pa.

## PETER F. LOFTUS CORPORATION

***Design and Consulting Engineers***

Electrical • Mechanical • Structural
Civil • Thermodynamic • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

## N. A. LOUGEE & COMPANY

*Engineers and Consultants*

REPORTS — APPRAISALS
DEPRECIATION STUDIES—RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway — New York

## LUCAS & LUICK

*Engineers*

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

221 S. LaSalle St., Chicago

## THE LUMMUS COMPANY

*Engineers and Constructors*

385 Madison Ave., New York, N. Y.

Chicago . . . Houston . . . London
Paris . . . The Hague . . . Montreal
Caracas . . . Bombay

## LUTZ & MAY

*Consulting Engineers*

STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS — ELECTRIC SYSTEMS
REPORTS — DESIGN — APPRAISALS

1009 Baltimore — Kansas City 6, Mo.

## CHAS. T. MAIN, INC.

*Engineers*

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

## PIONEER SERVICE & ENGINEERING CO.

Consulting and Design Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

221 So. La Salle St. — Chicago 4

## REIS & CHANDLER, INC.

ADVISORS TO UTILITIES

Financing—Rate of Return

30 Vesey Street, — New York 7, N. Y.

## SANDERSON & PORTER

*Engineers and*

*Constructors Reports and Surveys*

New York — New York

## SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

## F. W. SCHEIDENHELM

***Consulting Engineer***

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals

50 Church Street, — New York 7, N. Y.

## F. A. TUCKER, INC.

*Contractors—Engineers*

specialize in

Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 88½ Center Street, Rutland, Vt.
Branch Office—4612 Wilkinson Blvd., Charlotte, N. C.

## UTILITIES LINE CONSTRUCTION COMPANY, INC.

*Construction and Maintenance*

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road — Jenkintown, Pa.

## THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

CLASSIFIED **SEARCHLIGHT SECTION** ADVERTISING

EMPLOYMENT • BUSINESS • **OPPORTUNITIES** • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE:**
$1.50 a line, minimum 3 lines.
To figure advance payment count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.
PROPOSALS, $1.50 a line an insertion.
BOX NUMBERS count as 1 line additional.

**INFORMATION:**
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

**EMPLOYMENT ADVERTISING**
New Employment Opportunities Section for Displayed ads starting July 11th issue.

**DISPLAYED RATE:**
The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. E. W.

*SEND NEW ADVERTISEMENTS TO: 330 W. 42 ST., N. Y. 36, N. Y. for May 30th issue closing May 20th*

## ELECTRIC RATE EXPERT

Unusual opportunity for qualified expert with experience analyzing electric invoices as to correct rate, demand, etc. Background in dealing with utilities and regulatory Commissions essential. Electrical engineering degree preferred but not required. Permanent position with nationally known New York City firm. In reply give resume of experience, education, salary required. Replies held confidential.

P-5829, Electrical World
330 W. 42 St., New York 36, N. Y.

## UNUSUAL OPPORTUNITY

SALESMAN, experienced in calling on utilities, needed to head up a well established North Atlantic states territory for eastern manufacturer of pole line hardware specialties. Current earnings five figures. Expenses. Incumbent retiring because of exigencies beyond his control. Reply enclosing resume.

P-6233, Electrical World
330 W. 42 St., New York 36, N. Y.

## GENERAL MANAGER

For small manufacturing plant, Seattle area. Qualifications: Aggressive and of proven ability; Administrative and sales experience are essential. Preference will be given to applicants with degree in electrical engineering who are familiar with machine shop practice and power equipment. Salary open. Reply giving details of previous experience and references.

P-6380 Electrical World
68 Post St., San Francisco 4, Calif.

## ELECTRICAL DESIGNER OR DRAFTSMAN

Electrical Engineer or man with two years of college and extensive experience will find excellent opportunity in solid, energetic organization in Northern New Jersey. Should be 25–35 years of age and have five to ten years' experience in power wiring and power control. Ability to handle minor electronic and DC range drive work important. Electrical designing and drafting ability essential. Excellent employee benefits. Write with full particulars regarding personal history, education, experience and salary desired to

P-6341, Electrical World
330 W 42 St., New York 36, N. Y.

## Steam Power Plant Operations

### OPERATING MANAGER

### CHIEF STEAM PLANT ENGINEER

A major engineering and construction firm offers an excellent opportunity for the following positions requiring administrative experience in the operation and maintenance of modern steam power plants. Both positions will require foreign service of approximately 1 year.

**Operating Manager**

Requires 10 yrs. of experience, 5 of which must be in recent management of steam plant operations. Position involves supervision of the training of foreign operating personnel in U. S. and abroad.

**Chief Steam Plant Engineer**

(3 required). At least 5 yrs. recent supervisory with the ability to train foreign operating personnel in all phases of steam power plant operations. Please write immediately outlining complete chronological experience and salary history. Give full details regarding education, family status, age, salary expected. Reply to

P-6101, Electrical World
68 Post St., San Francisco 4, Calif.

*REPLIES (Box No.): Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (36)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*
*LOS ANGELES: 1111 Wilshire Blvd. (17)*

### *POSITIONS VACANT*

**Distribution Engineers—Graduate Electrical** Engineers—Senior—at least 10 years field experience with operating utility company. Junior 3 years experience. Permanent position long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-6463, Electrical World.

**Distribution Engineers—Two competent graduate** electrical engineers, age 30 to 40, with minimum 8 years experience design, operation and maintenance of distribution facilities, required by rapidly growing utility, desirable location South America, Portuguese or Spanish useful—not essential to start. Reply stating age, education, experience, personal particulars and minimum salary expected. P-6462, Electrical World.

**Electrical and Mechanical Engineers** positions available in transmission line design, distribution investigations and substation design. Want men with less than five years experience. Excellent employee benefits and promotion from within. Write to: Mr. R. E. Beatty, Consumers Power Company, 212 W. Michigan Avenue, Jackson, Michigan.

**Elecertical Engineer—with at least 10 years'** experience in power sytem stability problems. Requires thorough knowledge of electrical theory, symmetrical components, relay applications, and machine characteristics. Location—Midwest utility. Salary—open. Reply stating age, education, experience, personal data and minimum saalry expected. P-6351, Electrical World.

*WANTED*
## ELECTRICAL ENGINEER
for Public Utility. Technical Work.
*WRITE* ELECTRICAL ENGINEER
Central Illinois Public Service Co.
Springfield, Illinois

### OFFICIAL PROPOSALS

Bids: May 31, 1955

### *Power Authority Of The State Of New York*

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF
POWER CIRCUIT BREAKERS
SPECIFICATIONS NO. PA-5-14021
ST. LAWRENCE CONTRACT NO. P17

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture and furnishing of power circuit breakers and delivery thereof, f.o.b. the Authority's classification yard, Massena, New York in the following ways:

(1) If brought in person on the day of receiving bids until 10:30 A.M., Eastern Daylight Saving Time on the 31st day of May, 1955, 270 Broadway, Hearing Room C on the sixth floor, New York, New York.

(2) If mailed in until 10:15 A.M. Eastern Daylight Saving Time on the 31st day of May 1955, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

The proposal will be publicly opened and read aloud at the time and at the address given in (1) above.

Bids will be entertained for the power circuit breakers, associated equipment and services in accordance with the bidding schedules. Erection at the site of installation will be done by others but services of erecting engineers shall be provided by the manufacturers if and when required. Delivery of twelve 115 kv. power circuit breakers will be required by August 15, 1957, and twelve 230 kv breakers by May 15, 1958.

Plans, Specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, may be inspected by prospective bidders during office hours, and may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contract documents and Five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bid must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Bid deposit will be required with each bid in an amount not less than 10 percent of the maximum price bid for any schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

## POSITION VACANT

**Transformer engineer experienced in design** of dry type oil and of askarel immersed transformers up to 5000 KVA. Position is with aggressive fast growing company in Northern New Jersey.—Metropolitan New York area. Salary commensurate with ability. P-6365, Electrical World.

## EMPLOYMENT SERVICE

**Salaried Personnel, $3,000-$25,000.** This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Tayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

## POSITIONS WANTED

**Graduate Electrical engineer, 30 years of** age desires responsible position installing and maintaining carrier current, relaying, supervisory control and metering equipment. PW-6239, Electrical World.

**Electrical Engineer, age 29, married, 8 yrs.** experience—transformer design & manufacturing, desires opportunity to utilize experience with progressive company, will relocate, prefer midwest. PW-6451, Electrical World.

**Electrical Engineer, Age 32, BS in EE, de-**sires position with REA, Municipality or small utility. Experienced in all types of distribution and transmission line construction and maintenance. Capable of assuming complete charge on a system bases. PW-6412, Electrical World.

**Electrical Engineer, 25 years wide and varied** experience in supervision engineering, and operation of Utility Systems; steam, hydro, transmission and distribution. Desires responsible position with electric utility or industrial plan. Presently employed but desire change. PW-6493, Electrical World.

## PERIODICALS

**A.I.E.E. transactions back-volumes wanted to** buy for cash. Ashley, 24 E. 21, N.Y.C. (10).


**MANUFACTURER'S REPRESENTATIVE**

*Established 25 Years*

Calling on the electrical wholesalers and contractors, seeks an additional line preferably construction material. 3 salesmen covering Metropolitan New York area. Warehousing facilities available.

RA-6363, Electrical World
330 W. 42 St., New York 36, N. Y.

**ELECTRICAL WIRE AND CABLE**

—Your Best Source—

- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in Midwest
Let us quote on requirements—
send your inquiries
We'll also buy Surplus
Branch Offices
Houston— Yukon 8547 Los Angeles— ANgeles 3-5148

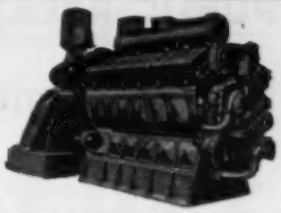
**UNIVERSAL** Wire and Cable Co.
2062 N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Cable: UNIWIRE

*Your Inquiries to Advertisers Will Have Special Value . . .*

—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information or more products or better service—more value—to YOU.

**DIESEL POWER**

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



*A PARTIAL LISTING OF OUR INVENTORY*

| KW | MAKE | Model | HP | RPM | KW | Make | Model | HP | RPM |
|---|---|---|---|---|---|---|---|---|---|
| 1180 | Worthington | SEH-6 | 1685 | 360 | 320 | Superior | 60S-6 | 460 | 450 |
| 1136 | Fairbanks Morse | 38D | 1600 | 720 | 300 | Fairbanks Morse | 32E14 | 450 | 300 |
| 1100 | General Motors | 16-278A | 1600 | 720 | 300 | General Motors | 8-268A | 450 | 1200 |
| 1000 | General Motors | 16-567B | 1440 | 720 | 280 | Clark | GD-4 | 375 | 360 |
| 750 | General Motors | 12-567 | 1080 | 720 | 200 | General Motors | 8-268A | 350 | 900 |
| 700 | Worthington | EE-8 | 1000 | 327 | 175 | General Motors | 12-71 | 275 | 1800 |
| 675 | Fairbanks Morse | 38D | 960 | 720 | 130 | Buckeye | 80 | 240 | 600 |
| 500 | General Motors | 8-567 | 720 | 720 | 148 | Fairbanks Morse | 32E14 | 220 | 300 |
| 500 | Alco | 6-121x13T | 750 | 600 | 100 | General Motors | 3-268A | 150 | 1200 |
| 350 | Baldwin | VO-6 | 510 | 450 | 60 | General Motors | 6-71 | 90 | 1200 |
| 320 | Enterprise | DSG-6 | 460 | 450 | | | | | |

**A. G. SCHOONMAKER COMPANY, INC.**
DIESEL DIVISION, 50-52 CHURCH ST., NEW YORK 7, N. Y.

Specialist for 47 Years in—

**LARGE POWER EQUIPMENT**

Do you receive our stock list? Prompt shipment from inventory. A.C. & D.C. Motors, Transformers, M-G Sets, Frequency Changers, Controls, Turbo-Generators and Circuit Breakers. Attractive prices for rebuilt-guaranteed equipment. Contact us before purchasing.

**BELYEA COMPANY, INC.**
51 Howell St. Jersey City 6, N. J.

**FOR SALE**

One W.H. Transformer, 100 KVA 33000/2400 oil-cooled, 1 phase, 60 cycles, subtractive polarity, Imp. 6.0 Ser. #463694. Two Moloney Transformers, 100 KVA, 16500/33000, oil cooled, 1 phase, 60 cycles, 2300 Volts to 2530, 5.25 Imp. subtractive polarity, Type FC, Serial No. 605530 & 531. Price can be arranged to suit purchaser.

FS-5985, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

**FOR SALE**

**IN OKLAHOMA and MISSOURI**

12 500 HP 4 cylinder vertical diesel engines and 5-3⅛" x 36" and 6-3¼" x 24" horizontal triplex plunger pumps fitted with steel fluid ends.

Operational changes render surplus. Complete data upon request. Would consider sale of either item separately.

**CITIES SERVICE PIPE LINE**
Patridge, Bartlesville, Oklahoma

**TRANSFORMERS**

**FOR SALE**

3—1000 Kva W-H 20000/34650-13200
3—1000 Kva Mol. 13200-2400/4160Y
6—1000 Kva Mol. 11500-2400/4160Y
3— 500 Kva G-E 22000-2300/4000Y
5— 333 Kva W-H 38000-7200/12470Y
3— 333 Kva G-E 33000-2300/4000Y/6900/-11950Y
3— 333 Kva G-E 33000-2300/4000Y
3— 333 Kva Wag 6900/11950Y 7200/-12470Y
3— 333 Kva Mol. 7200/12470Y-2400/4160Y
3— 100 Kva G-E 33000-6900/11950Y

Many other items in stock.

**TRANSFORMERS WANTED**

Reliable rewind and repair service on all makes of transformers

**THE ELECTRIC SERVICE CO.**
5316 Hetzel St.
Cincinnati 27, Ohio

*40 Years' Dependable Service*

**SYNCHRONOUS MOTORS**

3 phase, 60 cycle, 220 or 440 volts
(*2300 volts or higher)

| HP | MAKE | TYPE | P.F. | SPEED |
|---|---|---|---|---|
| 1400 | *West. | | .7 | 900 |
| 750 | *Westg. | | 1.0 | 900 |
| 750 | *G.E. | ATI | 1.0 | 900 |
| 600 | *G.E. | TS-7660 | 1.0 | 900 |
| 600 | *G.E. | TS-7657 | 1.0 | 514 |
| 450 | Westg. | HS | .8 | 1200 |
| 400 | West. | HG | 1.0 | 900 |
| 300 | G.E. | ATI | .8 | 720 |
| 300 | *Ideal | SMM | .8 | 277 |
| 300 | G.E. | ATI | .8 | 1200 |
| 250 | G.E. | ATI | .8 | 900 |
| 250 | G.E. (New) | TS-8764Y | 1.0** | 900 |
| 250 | G.E. | TS-6344 | 1.0 | 900 |
| 200 | Elec. Mach. | | 1.0 | 720 |
| 200 | F. Morse | TJC-388 | .8 | 720 |
| 150 | Elec. Mach. | | 1.0 | 720 |
| 150 | F. Morse | TJC-388 | .8 | 720 |

**CHICAGO ELECTRIC CO.**
1324 W. Cermak Rd. Chicago 8, Ill.

New and Used Equipment Available for
**POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION**
*Send for new list to*
**EBASCO SERVICES INCORPORATED**
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

# PUAA Names Copy Winners

**32nd annual Better Copy Contest provides certificates for 184 successful entries. McGraw-Hill ad given special award**

The Public Utilities Advertising Association, meeting in Chicago last week for its annual convention, announced the results of the 32nd annual Better Copy Contest.

There were 184 awards in 23 different classifications covering nearly every phase of advertising conducted by investor-owned utilities throughout the U.S., Canada, and Hawaii. The contest was open to non-members as well as members of the Association.

Two thousand and sixty-one entries were received in this oldest continuously conducted contest in the advertising field. Within 18 of the 23 classifications, entries were grouped according to size of competing companies. Group A included utilities with 400,000 or more customers, Group B included utilities with more than 150,000 but less than 400,000, and Group C was made up of utilities having up to 150,000 customers. In the remaining five classifications entries were judged as one group, regardless of the size of the company.

The following are the winners, excluding purely gas utility classifications:

**Complete Programs**—A, Commonwealth Edison Co; B, New Orleans Public Service, Inc; C, Portland Gas & Coke Co.

**One Series of Three to Five Newspaper Advertisements On a Public Relations Subject**—A, Northern States Power Co; B, Mississippi Power & Light Co; C, Jamaica Water Supply Co.

**Single Newspaper Advertisement on any Subject**—A, Northern States Power Co; B, Wisconsin Public Service Corp; C, Potomac Edison Co.

**Employee Magazines**—A, New York State Electric & Gas Corp; B, The United Illuminating Co; C, The Hartford Electric Light Co.

**Employee Newspapers**—A, Lone Star Gas Co; B, Arizona Public Service Co; C, Portland Gas & Coke Co.

**Any Series of Direct Mail Pieces**—A, Cleveland Electric Illuminating Co; B, Minneapolis Gas Co; C, Nantahala Power & Light Co.

**Any Single Booklet, Pamphlet, or Other Single Piece Distributed to Customers**—A, The East Ohio Gas Co; B, British Columbia Electric Co, Ltd; C, Texas Eastern Transmission Corp.

**Printed Material Used in Dealer Promotion on any Subject**—A, Duquesne Light Co; B, New Orleans Public Service, Inc; C, Washington Water Power Co.

**Special Employee Literature Other Than House Organs**—A, Southern California Edison Co; B, Wisconsin Power & Light Co; C, Union Gas Co of Canada, Ltd.

**Interior Displays**—A, Cincinnati Gas & Electric Co; B, Minneapolis Gas Co; C, Chattanooga Gas Co.

**Outdoor Advertising**—A, Pacific Gas and Electric Co; B, Peoples Natural Gas Co; C, Interstate Power Co.

**Motion Pictures**—The Cleveland Electric Illuminating Co.

**Window Display**—A, The Detroit Edison Co; B, Houston Natural Gas Corp; C, Minnesota Power & Light Co.

**Car and Bus Cards and Truck Posters**—A, Pacific Gas & Electric Co; B, British Columbia Electric Co, Ltd; C, Portland Gas & Coke Co.

**Annual Report to Stockholders**—A, Consolidated Edison Co of N. Y., Inc; B, Southwestern Public Service Co; C, Iowa Southern Utilities Co.

Honorable mention: Arizona Public Service Co.

**Radio Advertising**—Div. a, Kentucky Utilities Co; Div. b, Otter Tail Power Co.

**Television**—Div. a, Consolidated Edison Co of N. Y., Inc; Div. b, Atlanta Gas Light Co.

**Single Newspaper Advertisement on Light's Diamond Jubilee**—Commonwealth Edison Co.

**Single Newspaper Advertisement Promoting the Use of Electricity**—A, Cincinnati Gas & Electric Co; B, Southwestern Public Service Co; C, Hawaiian Electric Co, Ltd.

**Single Newspaper Advertisement Selling Electric Merchandise**—A, Duquesne Light Co; B, Wisconsin Public Service Corp; C, Hawaiian Electric Co, Ltd.

## *McGraw-Hill Ad Cited*

**The McGraw-Hill Publishing Co was chosen this year by PUAA for citation for an outstanding contribution to the investor-owned utility industry in the field of advertising.**

**This special citation, awarded for the first time to a publishing company, was made for the advertisement that appeared in leading newspapers in several major cities in March 1954. The ad set forth in detail the 20-year record of the electric power companies to show how it underwrites the companies' claim to public confidence.**

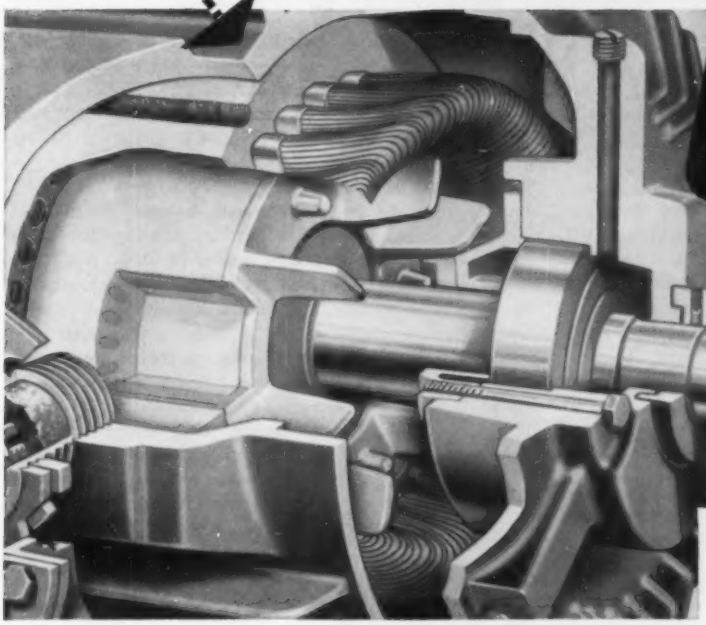
## Niagara Mohawk Plans

Niagara Mohawk Power Corp will soon launch a national advertising campaign to sell the advantages of upstate New York.

Earle J. Machold, president, said "there is vigorous competition today among various parts of the country to attract expanding industry and business. If we are to attract our share . . . (our) advantages will have to be sold vigorously."

The campaign, Machold said, would appear in national publications directed to business leaders and in papers throughout the areas the company serves.

# Get Both bearing features



**ALLIS-CHALMERS Totally-Enclosed Fan-Cooled MOTORS**

## fully enclosed and protected

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

## . . . yet easy to grease

You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.

**Look for the extra bolts** on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4609

# ALLIS-CHALMERS

# READERS FORUM

**Phenomena of Alternating Currents of Very High Frequency.**

BY NIKOLA TESLA.

ALTERNATE CURRENT MACHINES OF HIGH FREQUENCY; CURIOUS EXPERIMENTS WITH GEISSLER TUBES AND LAMPS; AN EXPLODED NOTION; NOISELESS ALTERNATING ARCS; CONSTANT CURRENT AND CONSTANT POTENTIAL; INTERESTING EXPERIMENT WITH A CONDENSER; THE FERRANTI-MAIN EFFECT; DA LIEGT DER HASE IM PFEFFER BEGRABEN; SUGGESTIONS OF MR. SWINBURNE.

## Nikola Tesla Wrote for EW

To the Editor:

The Nikola Tesla Committee of Yugoslavia contacted this Embassy in connection with their desire to obtain a copy of an article written by Nikola Tesla, entitled "Phenomena of Alternating Currents of Very High Frequency," and published in Electrical World, Vol. XVII, No. 8, Feb. 21, 1891.

Would it be possible for us to obtain either a photostatic copy of the article or a copy of the publication in which the article was issued.

Charlotte Muzar
Secretary to the Ambassador

Embassy of the Federal Peoples
Republic of Yugoslavia
Washington, D. C.

● Above is reproduced the headline of the article requested by and sent to Miss Muzar. Next year throughout the world many engineers will observe the 100th anniversary of the birth of this great scientist and inventor.

## Beware of Purchase Options

To the Editor:

These comments are intended to amplify your paragraph "When to Lease Machines" quoted from my talk before the Edison Electric Institute Sales Conference, as reported in ELECTRICAL WORLD for April 18 (p. 108).

The "Long Term Plans" to which I referred were not lease plans but were long term conditional sale contracts. Depreciation terms allowed by the government may be somewhat longer than those contemplated by some of the new 5 to 10-year conditional sales contracts. It is advisable to keep this possible discrepancy in mind in considering advertised plans.

Purchase options in leases are very dangerous unless the lease specifies that the machine may be purchased at the "fair market value" of the equipment at the time the option is exercised.

Our company has some printed material on the pros and cons of leasing which we are glad to make available to our friends in industry on their request.

Frank Griesinger
Assistant Treasurer

Lincoln Electric Co
Cleveland 17, Ohio

## Smithsonian Expanding Electric Exhibit

To the Editor:

The editorial, "First an Inventory, Then a Museum," in the March 28 issue is a timely one—almost, in fact, a timeless one—as it could be repeated every few years with good effect. A sad aspect of museum work is the lack of a continuing awareness among active people of the historical significance of what they accomplish from day to day. Too often the objects which would be inspiring museum pieces today are found to have been destroyed in the normal course of experimentation or obsolescence. Occasional editorial mention of this will encourage the saving of more significant machines.

The inventory would be useful to members of our staff and could very well be an additional means of calling attention to proper objects for preservation.

A museum devoted to electricity would be a fascinating one. Our plans are to expand the not insignificant electrical collection of the Smithsonian Institution in new space being developed in the old building. But when the Museum of History and Technology is a fact, we will have the opportunity to produce a fully effective and appropriate exposition of the electrical development.

Our bill to authorize this museum passed the Senate last session with unanimous consent, but it failed to be called up in the House of Representatives. It has been introduced again in both houses, and we are expecting hearings to be held on it within a few days.

The interest that you and other McGraw-Hill editors have shown in our effort to improve the national museums is encouraging and very helpful.

Leonard Carmichael
Secretary

Smithsonian Institution
Washington, D. C.

## Mrs Sprague Endorses Museum

To the Editor:

I have read with especial interest the article "First an Inventory, Then a Museum" on the editorial page, issue of March 28 of ELECTRICAL WORLD, which makes a most important suggestion.

Certainly everything possible should be done to encourage the careful preservation of all records relating to pioneer work in our great electrical industry; equipment, old plans, sketches, everything in any way relating to the early and accurate history of the electrical age which has played so vital a part in the development of our modern world.

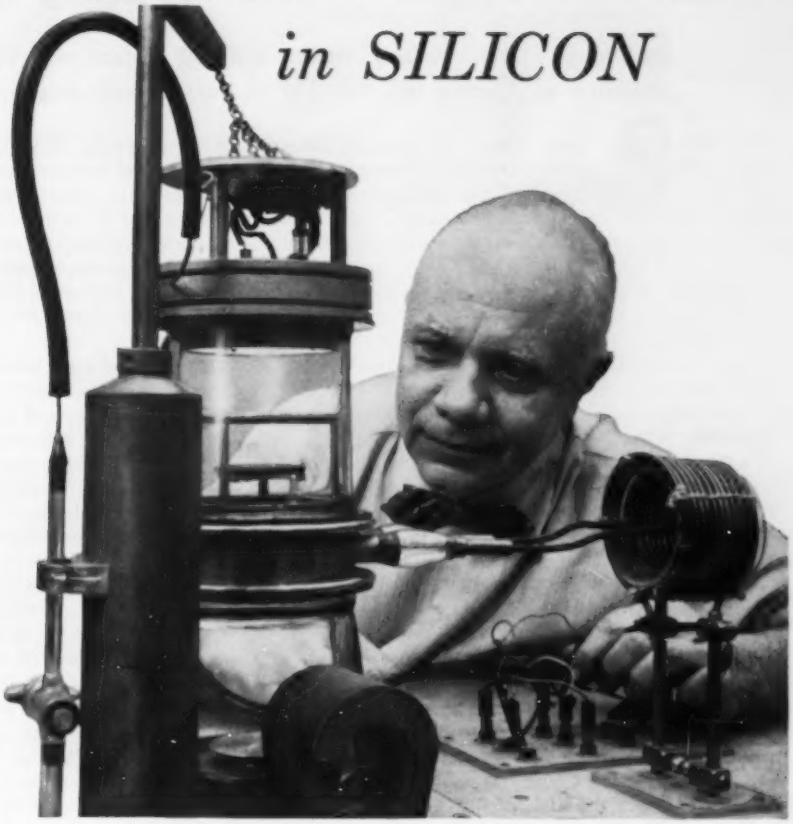
These records or copies should be on permanent exhibition in the Smithsonian Institution, Washington, D. C.; in the Franklin Institute, Philadelphia; and in a National Museum of Electricity if one should be created.

Harriet Sprague

159 East 49th St
New York 17, N. Y.

● Mrs Sprague is the widow of Frank Julian Sprague, electrical pioneer and inventor, who died in 1935.

# AN ADVENTURE *in SILICON*



*One example of junction technology at Bell Laboratories. Here a junction is produced on the surface of silicon by bombardment with alpha particles. Bombardment enhances silicon's performance at very high frequencies.*

One day in the 'thirties a revolutionary adventure began for Bell scientists. They were testing an experimental silicon crystal they had grown to make microwave detectors.

Intriguingly, they found that one end of the crystal conducted by means of positive charges, the other end with negative. Positive and negative regions met in a mysterious barrier, or junction, that rectified, and was sensitive to light. It was something entirely new . . . with challenging possibilities.

The scientists went on to develop a theory of junction phenomena. They showed that two junctions placed back-to-back make an amplifier. They devised ways to make reproducible junctions. Thus, junction technology came into being, and the 20th Century had a new horizon in electronics.

This technology has already produced at Bell Telephone Laboratories the versatile junction transistor (useful in amplifiers and switches); the silicon alloy diode (surpassingly efficient in electronic switching for computers); and the Bell Solar Battery which turns sunshine directly into useful amounts of electric current.

This is one of many adventures in science which make up the day-to-day work at Bell Laboratories . . . aimed at keeping America's telephone service the world's best.

## *Bell Telephone Laboratories*

*Improving telephone service for America provides careers for creative men in scientific and technical fields*

## IN THE INDUSTRY

# What's Wrong with the Heating Industry

**Year-round electric air conditioning will help remedy some of the problems of the warm-air heating industry, but its various weaknesses must be avoided**

Recent study of "The Warm-Air Heating Industry, prepared by the American Institute of Management, tells of some of the deficiencies in the established heating industry. Although it deals entirely with direct fuel heating, this study contains ideas and information pertinent to electric house heating and cooling.

The AIM study notes these weaknesses in the warm-air heating industry:

- Unethical practices, chiefly, by retail furnace installers and repairmen, are widespread. This has led to faulty and sometimes unsafe installations.
- Industry sales are almost wholly dependent on season and area.
- Research, while extensive, has not been adequate to keep up with market demands.

**Local Government Regulation May Be Desirable . . .** To remedy some of these weaknesses, AIM sees local government regulation as "most probable" if safe and adequate installation standards are to be assured. In fact, AIM believes that the whole warm-air heating industry might profit by some type of regulation.

Also, AIM believes the industry should designate a high-level industry advisory council to advise municipal and state agencies concerned with heating standards. Another duty of such a council would be to arbitrate grievances expressed by heating dealers in several areas toward equipment manufacturers.

Perhaps of most direct interest to utilities and others who have a stake in the electric air conditioning field is the recommendation that the present warm-air heating industry investigate the possibility of a single unit, year-round air conditioning device as a means of stabilizing its sales.

Manufacturers of electric house heating or cooling equipment, of course, have the prime responsibility for the avoidance of some of these deficiencies in the fast-growing electric air-conditioning field.

Such matters as house insulation, unit adequacy, wiring adequacy, proper and safe installation—all of these—are commanding considerable attention in the industry. No one doubts that the satisfied customer is the keystone to successful promotion of electric year-round air conditioning.

**Utilities Must Push Sales . . .** Utilities, too, have a role to play in promotion. This is confined mainly to advertising, promotion, and consultation on installations. It is the same kind of role that utilities have played pushing the sales and use of other load building devices. Where special situations arise, the utilities may step in with more direct aid. But generally the responsibility to assure safe and adequate equipment will rest with the dealer and the manufacturer.

At a recent industry meeting it was suggested that perhaps government regulation is needed to prevent improper installation of heat pumps and other electric heating and cooling devices. This indicates that some attention is being given to that possibility in the electric field just as it is in the warm-air heating field.

The AIM study makes the point that the market for single unit heating and cooling devices is tremendous. Around one million homes a year are being built, and over half the existing residential units have no central heating or cooling.

For the present the weaknesses in the established warm-air heating industry may be exploited to promote further the sales of electric heating and cooling equipment. At the same time, all segments of the industry must guard against these same weaknesses being carried over into the newer all-electric field.

## TECHNICAL NOTES

**Conductor sizes should probably be chosen as large** as is feasible for transmission lines that are, will, or may be part of a bulk power region in a power system. Seldom if ever has a conductor size been established as too large.

**Kelvin's Law is as applicable to bus conductors** as it is to transmission. Joints capable of high conductivity with low heat loss permit closer approach to economical current loading.

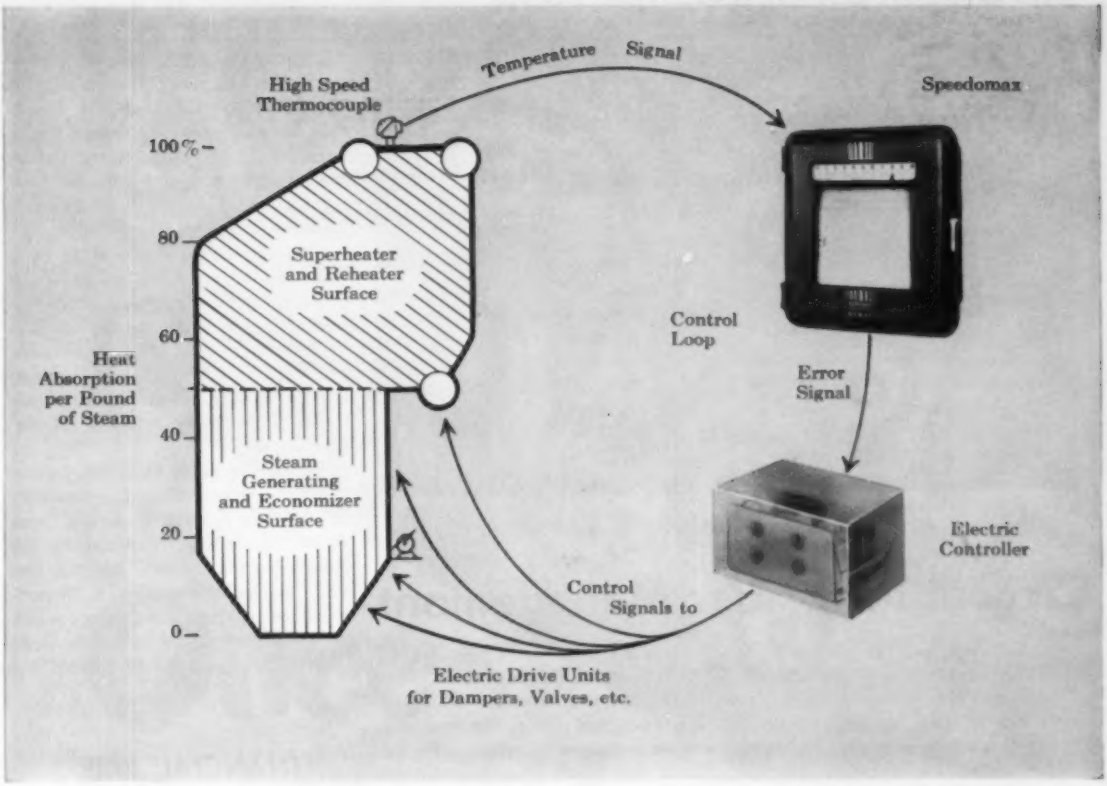
**Fading of microwave reception can come** from using paths of strong ground reflection. Changes of a few feet in antenna height or 100 ft horizontally sometimes yield marked improvement.

**Lowest cost for most industrial distribution systems** is at 480 v.

**Flashover voltage of a high-voltage switch gap** may approach either that of a sphere gap or a rod gap depending on the design of the switch parts.

**Cross-compound unit control is somewhat more intricate** than for tandem compound units because the rotors of the compound sets are tied together only on the bus.

**Underground cable taps from open-wire secondaries** on racks can be streamlined by use of a vertically elongated cable terminal with side bushings mounted beside the rack




## THIS STEAM TEMPERATURE CONTROL

# puts heat where you want it!

● Because superheater and reheater surfaces of many modern boilers receive 50 per cent—or more—of the heat liberated, the proper control of heat distribution is a governing factor in attaining efficiency. Steam temperature control, by regulating this distribution, maintains optimum Btu /lb of steam, and helps prevent overheating of the metal surfaces.

L&N's *all-electric* steam temperature control solves this critical problem effectively over a wide range of load and furnace conditions. The basic components of the control are as follows:

**High Speed Thermocouples**—Especially designed to provide accurate sensing of temperature, with a response several times as fast as non-specialized thermocouples.

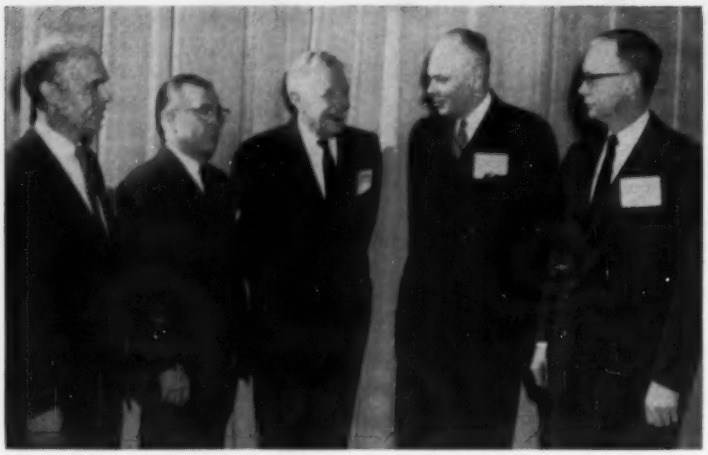
**Speedomax Recorders**—Provide sensitivity, accuracy and proved reliability of measurement; with auxiliary alarms and control safeguards specified for this very exacting service.

**Versatile Electric Controller**—With control actions—proportional, reset and rate—tailored to meet not only the requirements of a single operating condition (such as control of a valve), but also of *added* operating conditions (as when control must be transferred to dampers or other devices). Preliminary control action, initiated from changes in boiler air flow, is similarly tailored for each operating condition. Reheat unit control systems are coordinated to prevent one temperature control from interacting with or upsetting the other.

**Electric Drive Units**—Provide dependable, positive positioning of dampers, valves, burners, etc. under conditions both normal and adverse.

Let our engineers work with you to arrive at an effective solution of your superheat—reheat control problems. Please address us at 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP
instruments automatic controls • furnaces



Speakers at EEI-AGA accountants meeting stress . . .

# Accounting Aid to Management

The growing value of accounting to management was stressed at the Edison Electric Institute-American Gas Association general session of the National Conference of Electric and Gas Utility Accountants held recently at Chicago.

The "increasing participation on the management team" of utility accountants, said Harold Quinton, president of EEI and of Southern California Edison Co, has given them the "constructive and creative role" they are playing in helping to keep stockholders, the public, labor, and governmental authorities informed on utility operating and financial matters.

The EEI president said that "simplicity and adequacy" in information and reporting activities are most desirable features. He also directed attention to the fact that top management must deal with summarized figures and is intensely interested in "interpretive data and forecasts."

### Mechanization Cited

The accounting executives are to be complimented, he continued, for the splendid job they have done in keeping the utility industry abreast of developments in mechanization. The industry was one of the first to develop automation techniques "with unattended or automatic hydro plants since 1922, and in office operations with the adoption of the extensive use of punched cards," he pointed out.

The next step in mechanization in both plant and office, Quinton said, will be electronic computers. He declared that many people concerned with them feel that the "real benefit (from these machines) will be realized in the area of more accurate and timely information rather than in the area of savings in clerical costs."

### Automation Frees Accountant

A. Paul Thompson, vice president and treasurer of Iowa Power & Light Co, said that among the outstanding developments for the past quarter-century were the "increasing usefulness of accounting to management" and the "greater emphasis upon the animate factors" in business enterprise.

Automation in plant operations or in increasing mechanization of offices, he observed, would be "favorable to more original thinking and less human robotism. Electronic devices are not competing with us," Thompson continued, "nor are they making the role of an accountant easier, but rather they are serving us, freeing us to think, and placing a higher premium on accounting skill."

He urged the accountants "to see our business through the eyes of the chief executives, the operators, the engineers." A series of "management key indicators" were offered by Thompson, to aid in measuring company performance and prospects. They included administrative indicators "slanted primarily toward policy formation"; and supervisory indicators, such as man-hours per customer served, which relate "to the direct handling of personnel and equipment."

"It is high time that men of business demand machines designed specifically for their purposes, instead of purchasing and attempting to use equipment intended for something entirely different," Dr Howard Aiken, director of Harvard University's computation laboratory, told the convention delegates.

"There are many favorable factors that offer unprecedented opportunity in 1955" for American business, Gene Flack, sales counsel and director for advertising for Sunshine Biscuits, Inc, said. He mentioned a U. S. Department of Commerce survey which shows that "personnel income is ahead of last year by about $7 billion."

## FINANCIAL BRIEFS

**Southern Indiana Gas & Electric Co** is planning to buy the Rockport, Ind., Waterworks Co power plant . . . Kidder, Peabody & Co has placed privately $8 million first mortgage 3.35% bonds due 1985 of **Green Mountain Power Corp** and 35,000 shares 4.65% cumulative preferred stock of **Arkansas-Missouri Power Co . . . Lake Superior District Power Co** has split its $20 par value common stock into two shares of $10 par each, effective April 29. Company will pay on June 1 a dividend of 27½¢ a share on the $10 par as compared with 50¢ on the $20 par stock.

**San Diego Gas & Electric Co** is expecting to raise about $11 million in new financing during 1955 . . . **Virginia Electric & Power Co** will pay June 20 a quarterly common stock dividend of 40¢ a share as compared with 35¢ in the previous quarter.

**Massachusetts Supreme Court** has upheld a lower court decision which gave an opposition group of stockholders of Puget Sound Power & Light Co, headed by Laurence M. Marks, New York City, access to company's list of

# Once is not enough!

The need for blood is greater than ever, not only for men wounded in combat, but here at home . . . to cure disease, to meet accidents and disasters, and to prepare for civil defense.

Our quota can ONLY be met, if those who give *keep on* giving . . . regularly!

You CAN give more than once . . . as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give goes to someone who needs it desperately.

Remember . . . once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

# GIVE BLOOD

...give it again and again

**BUSINESS EXECUTIVES!**

**CHECK THESE QUESTIONS**

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . . the need for blood is **urgent!**

**NATIONAL BLOOD PROGRAM**

stockholders. The group will study the decision before deciding further action, Francis Currie, New York lawyer and secretary of the Marks committee, said recently. Because of the court ruling, Puget is expecting to be able to hold a stockholders' meeting soon.

**After a pending common** stock offering, Potomac Electric Power Co expects to earn between $1.27 and $1.30 a share as compared with $1.17 a share in 1954, Pres Roy Dunn told New York Society of Security Analysts.

**American Gas & Electric Co** and General Electric Co are two of eight industrial organizations which will cosponsor "How to Invest Show." It will be held in the 71st Infantry Regiment Armory, Park Avenue and 34th Street, New York on May 24-30, under the sponsorship of Merrill, Lynch, Pierce, Fenner & Beane.

**Wisconsin Power & Light Co** is planning to offer 263,140 shares of common stocks to its stockholders on a 1-for-10 basis . . . **Public Service Co of New Hampshire** is also planning to offer its stockholders 413,016 shares on 1-for-6 basis.

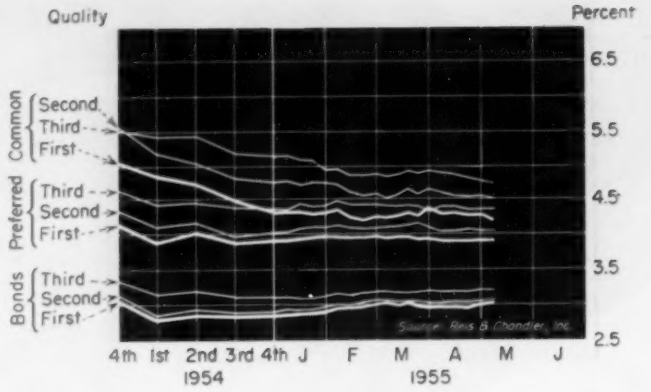
**Stockholder Subscriptions . . .** Oklahoma Gas & Electric Co stockholders subscribed to 326,244 common shares of 331,643 shares offered on a 1-for-8 basis at $31.50 a share. Balance of 5,399 shares was taken by officers and employees . . . Kentucky Utilities Co stockholders took 135,448 common shares of 190,566 shares offered on a 1-for-12 basis at $24.75 a share. Unsubscribed shares were sold by the underwriters headed by Blyth & Co.

## REGULATION BRIEFS

**Villisca, Iowa,** Municipal Electric Light Plant has reduced rates by 10% . . . **Snohomish County Public Utility District No. 1** has reduced rates by $325,000 a year . . . **Pacific Power & Light Co** has received Oregon Public Utilities Commission approval to reduce rates in the Coos Bay and Williamette Valley Divisions by an estimated $302,000 a year.

**Franklin County, Wash., Public Utilities District** has reduced rates about $70,000 a year.

## Today's Utility Yields—(%)




| | BONDS | | | PREFERRED STOCKS | | | COMMON STOCKS | | |
|---|---|---|---|---|---|---|---|---|---|
| QUALITY | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 1st | 2nd | 3rd |
| May 5 | 3.02 | 3.07 | 3.19 | 3.92 | 4.04 | 4.37 | 4.24 | 4.50 | 4.80 |
| April 28 | 3.00 | 3.05 | 3.19 | 3.92 | 4.04 | 4.37 | 4.29 | 4.52 | 4.83 |

## Utility Earnings

| COMPANY | PERIOD MONTHS ENDED | | NET INCOME 1955 | NET INCOME 1954 | EARNINGS PER COMMON SHARE 1955 | EARNINGS PER COMMON SHARE 1954 |
|---|---|---|---|---|---|---|
| Baltimore Gas & Electric | 12 | Mar. | $12,690,000 | $10,164,000 | $2.02(a) | $1.71(a) |
| Central Illinois Public Service | 12 | Mar. | 8,042,536 | 5,973,812 | 2.13(b) | 1.55(b) |
| Columbus & Southern Ohio Electric | 12 | Mar. | 5,600,502 | 5,473,228 | 1.97(c) | 2.10(c) |

Notes—(a) Based on 5,758,561 shares in 1955 and 5,410,771 shares in 1954; (b) Based on average number of shares; (c) Based on 2,401,360 shares in 1955 and 2,201,360 shares in 1954.

## Utility Financing

| COMPANY AND DESCRIPTION | AMOUNT OF OFFERING (000) | OFFERING PRICE | YIELD TO PUBLIC |
|---|---|---|---|
| MAY 5-11 | | | |
| BONDS | | | |
| Georgia Power—1st mtg 3⅛% due 1985 | $12,000 | 101.03% | 3.32% |
| Jersey Central Power & Light—1st mtg 3½% due 1985 | 20,000 | 102.824 | 3.35 |
| COMMON STOCK | | | |
| Florida Power Corp—232,557 sh (being offered commonholders on 1-for-10 basis, record May 11 to expire May 31) | $10,000 | $43.00 | 3.72% |
| Iowa Public Service—270,220 sh (being offered commonholders on 1-for-10 basis, record May 11 to expire June 1) | 4,188 | 15.50 | 5.16 |
| SCHEDULE FOR MAY | | | BID DATE |
| BONDS AND DEBENTURES | | | |
| Southern California Edison—conv. debs due 1980 (to be offered common and preferred holders on the basis of one right for each share held on May 17 with 20 rights entitling holder to subscribe for $100 of debs. Offering will expire June 14) | $40,951 | $100.00 | ..... |
| Ohio Edison—1st mtg due 1985 | 30,000 | ..... | May 17 |
| Potomac Electric Power—1st mtg due 1990 | 10,000 | ..... | May 23 |
| Alabama Power—1st mtg due 1985 | 15,000 | ..... | May 24 |
| Brockton Edison—1st mtg due 1985 | 6,000 | ..... | May 25 |
| PREFERRED STOCK | | | |
| Public Service of Oklahoma—100,000 sh $100 par | $10,000 | ..... | May 17 |
| COMMON STOCK | | | |
| Potomac Electric Power—511,660 sh (to be offered common holders on 1-for-10 basis, record May 23) | ..... | ..... | ..... |

# STATISTICS

## Some Finals and Semifinal Figures of the Year

**Capacity . . .**

| | 1954 (thousand kw) | 1953 (thousand kw) |
|---|---|---|
| Installed Year-End | | |
| utilities | 102,520 | 91,502 |
| other sources | 16,365 | 15,852 |
| total | 118,885 | 107,354 |
| Capability at Dec. Peak | 107,800 | 95,500 |
| Non-Coincident Peak Load | 88,700 | 81,200 |
| Reserve Margin (%) | 21.5% | 17.6% |
| Load Factor (%) | 60.7% | 62.2% |
| Changes in Capacity | | |
| new additions | 11,434 | 9,521 |
| retirements | 448 | 276 |
| adjustments plus | 249 | 199 |
| adjustments minus | 217 | 168 |
| net additions | 11,018 | 9,276 |

**Generation . . .**

| | 1954 (million kwhr) | 1953 (million kwhr) |
|---|---|---|
| Utilities | 471,609 | 442,665 |
| Other Sources | 73,036 | 71,504 |
| total | 544,645 | 514,169 |
| Net Imports | 2,325 | 2,008 |
| total available | 546,970 | 516,177 |
| Estimated Population | 161,195,000 | 158,306,000 |
| Kwhr per Person | 3,393 | 3,261 |
| Kwhr per Kw of Installed Utility Capacity | | |
| hydro | 4,737 | 4,956 |
| steam | 4,999 | 5,256 |
| IC | 1,686 | 1,789 |
| total | 4,861 | 5,096 |

Source: Edison Electric Institute Statistical Bulletin #22
1954 figures preliminary, 1953 revised

## Power Statistics . . .

| | | Latest Month | Preceding Month | Year Ago | Annual Change % |
|---|---|---|---|---|---|
| Capacity | Mar. | 104.93 | 103.74 | 92.99 | 12.8 |
| Peak—Class I Systems (million kw) | Feb. | 83.9 | 84.1 | 74.9 | 12.0 |
| Estimated Dec. '55 Peak | Feb. | 96.4 | 95.7 | 96.2 | 0.2 |
| Production—billion kwhr | Feb. | 40.23 | 43.96 | 35.21 | 14.3 |
| hydro | | 8.57 | 9.43 | 8.56 | 0.1 |
| fuel | | 31.66 | 34.53 | 26.65 | 18.8 |
| Sales—billion kwhr | Feb. | 38.99 | 39.26 | 34.08 | 14.4 |
| residential | | 11.57 | 11.70 | 10.36 | 11.7 |
| commercial | | 6.20 | 6.23 | 5.72 | 8.3 |
| industrial—includes sales to AEC | | 19.11 | 19.15 | 15.99 | 19.5 |
| other | | 2.11 | 2.18 | 2.01 | 5.1 |
| Fuel Consumption | Feb. | | | | |
| coal—million tons | | 11.09 | 12.02 | 9.07 | 22.3 |
| oil—million barrels | | 7.43 | 8.91 | 5.70 | 30.4 |
| gas—billion cu ft | | 63.63 | 65.13 | 75.74 | −16.0 |
| Net Income Class A & B Co's—$ million | Jan. | 112.60 | 109.05 | 111.44 | 1.0 |
| Residential Customers—millions | 12 mos. | 43.26 | 43.14 | 42.04 | 2.9 |
| revenue per kwhr | ended | 2.69¢ | 2.69¢ | 2.73¢ | −1.5 |
| avg. kwhr per customer | Jan. | 2,564 | 2,549 | 2,365 | 8.4 |
| avg. annual bill | | $68.97 | $68.57 | $64.56 | 6.8 |

## Business Statistics . . .

| | | | | | |
|---|---|---|---|---|---|
| Indexes: 1947-49 = 100 | | | | | |
| FRB Industrial Production | Mar. | 137 | 135 | 126 | 8.7 |
| ENR Construction Cost | May. | 137.0 | 135.7 | 129.7 | 5.6 |
| BLS Cost-of-Living | Mar. | 114.3 | 114.3 | 114.8 | −0.4 |
| NEMA Sales | Feb. | | | | |
| insulation materials | | 137 | 132 | 120 | 14.2 |
| electric appliances | | 118 | 118 | 98 | 20.4 |
| household refrigerators | | 94 | 96 | 91 | 3.4 |
| Wholesale prices | Mar. | | | | |
| motors and generators | | 121.0 | 121.0 | 124.2 | −2.6 |
| transformers and regulators | | 127.8 | 127.8 | 128.1 | −0.2 |
| switchgear and fuses | | 135.4 | 135.4 | 135.1 | 0.2 |
| GNP—annual rate—$ billion | 1st Qtr. | $369.0 | $362.0 | $355.8 | 3.7 |

# Cole Electric Co.

8439 Steller Drive TExas 0-4701 Culver City, Calif.

**AIR BREAK DISCONNECTING SWITCH**
**115,000 volts — 1200 amperes**
**Type 0-2**
**Underhung mounting. Three-pole, single throw.**
**Group operated. One pole shown.**
**Silver to silver contacts.**

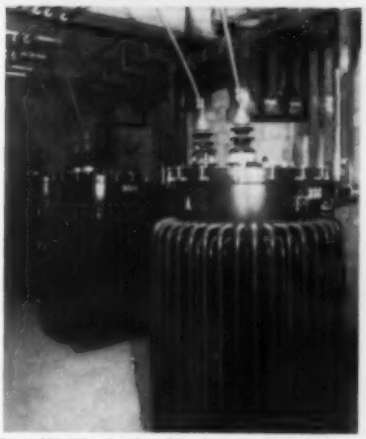
# IT'S GARDNER TRANSFORMERS
# FOR NEW NBC-TV STUDIOS

NBC's new up-to-the-minute color television studios in Burbank, California.

NATIONAL BROADCASTING COMPANY has used Gardner Transformers for years with complete satisfaction... and that makes it only natural that Gardners were chosen for the Company's new color television studios in Burbank, California. The three Gardner Transformers shown here were shipped in September, 1954 and installed by the Public Service Department of the City of Burbank with the cooperation of the Los Angeles Office of Fischbach and Moore, Incorporated, electrical contractors.

For transformers that will meet your needs exactly and provide top performance year after year... specify Gardners.

*We are always glad of the chance to help solve special problems. Our experience is unequalled and our production line is flexible. Write for information—Gardner Electric Manufacturing Company, 4227 Hollis St., Emeryville (Oakland), California.



These 500 KVA Gardner Transformers, 2500/4330Y to 500/250/125 volts are served by the City of Burbank, Public Service Department, which has also been a consistent user of Gardner Transformers for many years.

**GARDNER ELECTRIC MANUFACTURING COMPANY**

Subsidiary of

**FEDERAL PACIFIC**

**ELECTRIC COMPANY**

MAIN OFFICE: 50 PARIS STREET • NEWARK 1, NEW JERSEY

**Federal Pacific products:** Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct, High Voltage Circuit Breakers and Power Switches ★ Sales offices in principal cities.

# KUHLMAN POWER TRANSFORMERS

## engineered for top performance... built for long life

### Rigid, sturdy construction

1. Leads and lead guides well supported with sufficient electrical clearance.
2. Core clamps prevent shifting or vibration.
3. Pressure studs and steel clamping rings hold coils solidly in place.
4. Tank of heavy steel plate reinforced by fabricated channels.
5. Keyed radial spacers support, separate, and firmly anchor individual coils.
6. Heavy tie rods to resist short circuit and lifting forces.
7. Rigid insulating blocks between coil stack and steel clamping ring.

### High electrical efficiency

8. Continuously wound coils with minimum electrical resistance and neat coil section connections.
9. End coils reinforced for surge protection.
10. Static shield for voltage stress equalization at high voltages.
11. Cable lead connections brazed or crimped.
12. Core of laminated oriented steel with cruciform cross section.

### Coordinated insulation

13. Insulation barrier between high and low voltage windings.
14. Core insulation.
15. Barrier between high voltage coils.
16. Insulation between core yoke and coil stacks.
17. Detachable core grounding strap.

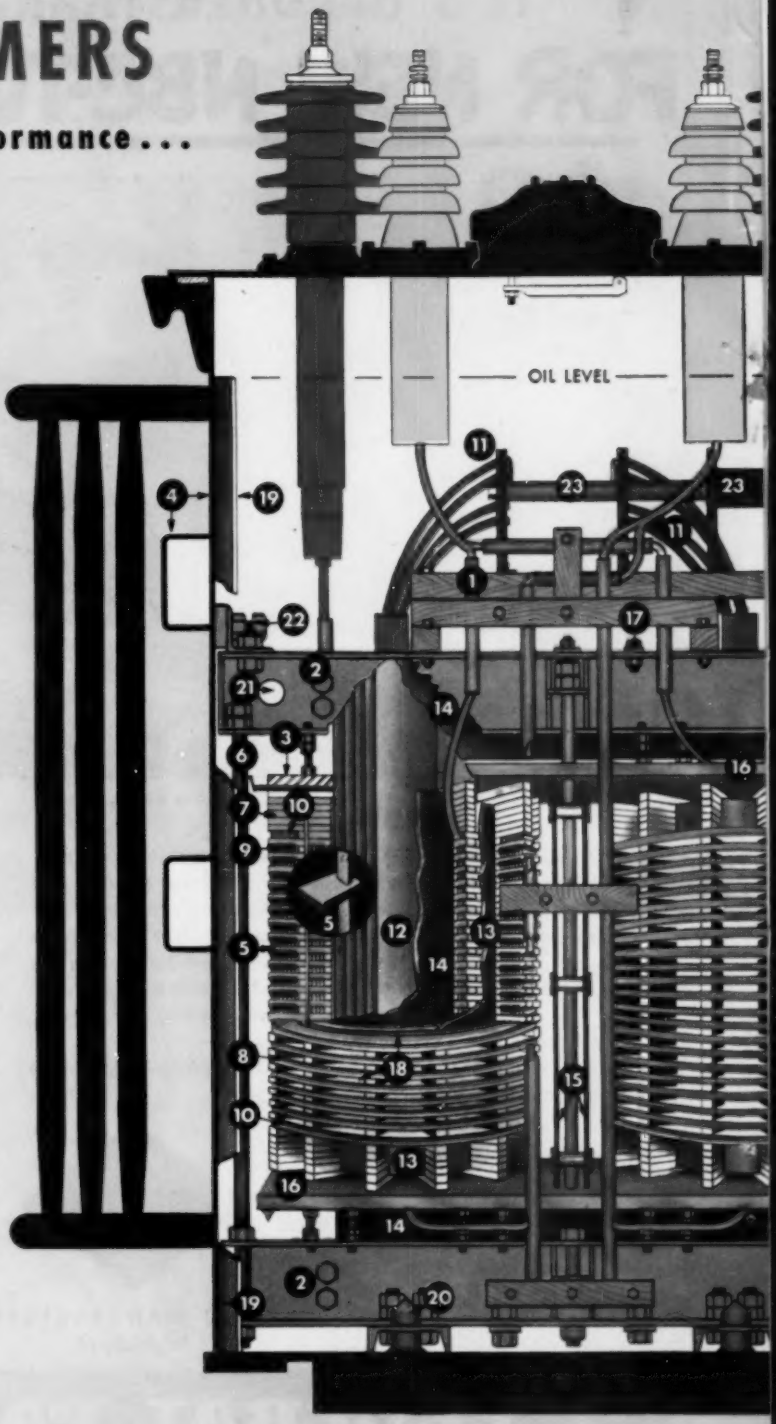
Entrapped moisture and air forced out by heat and vacuum treatment.

### Good thermal protection

18. Large ducts formed by radial and vertical spacers assure good circulation to all parts of the windings; thus eliminating danger of "hot spots".

### Accessible and easily handled

19. Guide for lowering core and coil into tank.
20. Pins for positioning core and coil.
21. Core clamp lifting eye.
22. Tank anchor bolt locks core and coil to tank.
23. Tap changer at top of core and coils for ease of inspection.




# KUHLMAN

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA